Latvia University of Life Sciences and Technologies

19th International Scientific Conference
STUDENTS ON THEIR WAY TO SCIENCE
(undergraduate, graduate, post-graduate students)
Collection of Abstracts
April 19th, 2024

Jelgava
2024

ISSN 2255-9566

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Collection of abstracts from the 19th International Scientific Conference. – Jelgava, 2024. – 93p.

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The conference is aimed at dissemination of scientific research results, sharing of experience, improvement of foreign language and cross-cultural communication skills, and establishing of international contacts.

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AGRICULTURE

THE INFLUENCE OF *BACILLUS AMYLOLIQUEFACIENS* ON THE EXPRESSION OF GENES OF PATHOGENESIS-RELATED (PR) PROTEINS OF TOMATO PLANTS AND THEIR ROLE IN PLANT DEFENCE

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Tomatoes are one of the most common agricultural crops, and very often there is a problem of crop loss due to adverse environmental conditions, pests or pathogens. The symbiosis of endophytic microorganisms with plants can contribute to the growth and development of the plant and improve its defense system. This topic is relevant and is actively researched by scientists from all over the world. The aim of the present study was to investigate the interaction of endophytes, in particular *Bacillus* species, with tomato plants and their ability to influence the expression of genes of pathogenesis-related (PR) proteins.

This study was conducted in the laboratory of biotechnology and cell engineering of the National University of Life and Environmental Sciences of Ukraine (NULES). The study was conducted using 2 varieties of tomatoes - "Sanka" and "De Barao" and 2 strains of *Bacillus amyloliquefaciens*. In order to study the influence of endophytic bacteria on the growth and development of tomato plants, as well as on their resistance to fungal pathogens, a preparation based on *B. amyloliquefaciens* was created. Plants were regularly fed with this preparation. Plants were grown in a greenhouse located on the territory of the fruit and vegetable garden of the NULES. The difference in the degree of damage by pathogenic fungi between experimental and control plants was investigated. Using the method of thin-layer chromatography and spectrophotometry, the qualitative and quantitative composition of secondary metabolites in the samples was evaluated. One of the stages of the research was the isolation of RNA from plants, after which reverse transcription was carried. Subsequently, the conditions were optimized and real-time PCR was performed. To assess gene expression of PR-proteins in tomato plants the expression of three target genes (PR-1, Phenylalanine ammonia-lyase and Lipoxygenase (Lox)) was studied and compared with the expression of reference genes (Actin and β-tubulin).

Based on the results of the research, it was possible to detect the expression of all three target genes. The expression of Lox and PR1 genes increased in experimental samples of both varieties of tomatoes. Visual and molecular genetic analysis of experimental and control samples showed that under the action of *B. amyloliquefaciens*, the intensity of synthesis of phenolic compounds in plant leaves decreased, while systemic resistance against pathogenic fungi increased. Thus, further research is needed as endophytes can be an effective plant protection agent and an integral part of both organic farming and agriculture in general.

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THE CONTRIBUTION OF BIOECONOMY TO THE DEVELOPMENT OF COUNTRY`S ECONOMY: USING THE EXAMPLE OF AGRICULTURE, FORESTRY AND FISHERIES

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The contribution of bioeconomy to the development of Uzbekistan's economy, particularly within the sectors of agriculture, forestry, and fisheries, holds significant potential for driving sustainable growth and fostering resilience. Against the backdrop of Uzbekistan's ambitious economic reforms and its strategic focus on diversification and modernization, this research aims to examine the role of bio-based industries in enhancing productivity, promoting environmental sustainability, and creating new opportunities for economic development. By analyzing the current state of these sectors and exploring the untapped potential of bioeconomy strategies, this study seeks to provide insights into how Uzbekistan can harness its natural resources and leverage technological innovations to accelerate its transition towards a more inclusive and resilient economy. Through a comprehensive assessment of policies, investments, and institutional frameworks, this research endeavors to offer evidence-based recommendations for policymakers, investors, and other stakeholders interested in unlocking the transformative power of bioeconomy in Uzbekistan's economic development journey.

The theoretical sources underpinning the exploration of the contribution of bioeconomy to the development of Uzbekistan's economy, with a focus on agriculture, forestry, and fisheries, are varied and rich in insights. The first source in our reference list is " The Bioeconomy in Europe: An Overview " by McCormick and Kautto. This work provides a comprehensive overview of the bioeconomy revolution and its potential implications for sustainable development. In analyzing this source, it becomes evident that the author’s emphasis on sustainability aligns closely with Uzbekistan's development priorities. As Uzbekistan seeks to modernize its agricultural practices, enhance forest management, and promote sustainable fisheries, insights from this source can inform policy decisions and investment strategies aimed at leveraging the potential of bioeconomy.

Through a comprehensive analysis of theoretical sources and contextual factors, several key insights emerge:

Firstly, bio-based industries offer Uzbekistan opportunities to enhance productivity, promote environmental sustainability, and create new economic avenues. By leveraging its abundant natural resources and embracing innovative technologies, Uzbekistan can modernize its agricultural practices, improve forest management, and sustainably harness its fisheries resources. Secondly, the integration of bioeconomy principles into policy frameworks is essential for unlocking the full potential of these sectors. Policies that prioritize sustainable resource management, promote research and innovation, and foster collaboration between government, industry, and civil society can create an enabling environment for bioeconomy development.

Overall, by embracing the principles of sustainability, innovation, and collaboration, Uzbekistan can harness the transformative power of bioeconomy to drive inclusive and resilient economic development. Through targeted investments, policy reforms, and stakeholder partnerships, Uzbekistan can position itself as a leader in sustainable bio-based industries, contributing to both national prosperity and global environmental stewardship.

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ADVANCEMENT OF MOLECULAR RESEARCH TECHNIQUES FOR INVESTIGATING SELF-INCOMPATIBILITY GENETICS IN CHAENOMELES JAPONICA

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The plant genus *Chaenomeles* falls under the subfamily *Maloideae* within the *Rosaceae* family and encompasses five recognised species indigenous to central and eastern Asia. They were introduced in Europe and are widely cultivated as various ornamental plants [1]. Only at the beginning of the last century was interest raised and breeding activities for *Chaenomeles*, especially the species *C. japonica*, to become a full-fledged fruit crop. Latvia is one of the first to get involved in this process - the first officially and internationally registered cultivars were created here [2]. One of the breeding tasks is to obtain self-fertile cultivars, ensuring more efficient pollination in commercial orchards. Therefore, the following hypothesis was stated - *Chaenomeles japonica* operates the same self-incompatibility system as in the related genera *Malus*, *Pyrus*, and *Sorbus* and is determined by an analogous *S*-gene. In order to confirm the hypothesis, the following aim of the study was set - to test the *S*-gene-specific molecular markers used in the related genera (*Malus*, *Pyrus* and *Sorbus*) in *Chaenomeles japonica plants*. The study was conducted in 2022-2023, using the Institute of Horticulture (LatHort) Japanese quince germplasm and breeding collections, including 70 C. japonica genotypes. Plant material was collected at the beginning of the vegetation season, and DNA extraction and quality assessment were performed. Examining *S*-gene-specific molecular markers of related species was performed using the PCR method and genotyping by genetic analyser. Amplified fragments were sequenced using an Oxford Nanopore MinION device, with data analysed by SEED2 software. Successful and stable amplification was observed for markers corresponding to the first and second introns of the *Sorbus aucuparia* and *Crataegus monogyna S*-gene. Amplification fragment analysis discovered an appropriate number of amplification fragments that were insufficiently resolved. In order to confirm molecular marker transfer, the PCR products were sequenced. As a result, 21253 sequences were obtained, and 15 groups of sequences were found at a 90% similarity level. The similarity analysis of the representative sequences with the information in the data bank (BLAST NCBI) showed *C. japonica* similarity with relative *Malus* species *S*-genes. The study showed the possibility of applying the molecular markers developed in other Malus species to identify the self-sterility gene in the genus Chaenomeles plant material. It is vital in the breeding process to create self-fertile cultivars or develop cross-compatibility schemes for existing cultivars for growers.

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CARBONATE CONTENT IN THE SOILS OF ZEMGALE PLAIN

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Soil is the growth medium for plants, where they absorb the necessary nutrients and water. Therefore, it is a crucial aspect for human health, social and economic well-being. Soil is very diverse and has various factors which influence plant growth, one of them being carbonates. Zemgale plain of Latvia, which is the study area of this research, is characterized and known for its carbonate rich soils. Taking into account that Zemgale plain is homogenous in its relief, it might hint that carbonate content is the same everywhere in soils, however, it is not true as Zemgale plain parent material is diverse. Therefore an investigation needs to take place to describe carbonate spatial variations. As carbonates have a large impact on soil properties and plant nutrient uptake, it is essential to understand their spatial variations to make better decisions for agriculture sector purposes.

Soils of Zemgale plain has developed mainly from clayey glaciolimnic and loamy moraine deposits with various admixture of carbonate-containing material. Sedimentary deposits which contain carbonates are reported to be mainly clay based with carbonate content 10 – 30%. These carbonates contained in glacial deposits are overlaid by silty sand, other clayey material or sandy material with high silt content thus forming complex soil parent material, which has limited water infiltration capability [1].

The data used in this research were acquired from the project "Enhancement of sustainable soil resource management in agriculture" (E2SOILAGRI) implemented by Latvian Ministry of Agriculture in collaboration with partners, thanks to financial aid of Norway grants and national co-founding. Numerous soil profiles across Latvia were researched within the project, and many of them were in Zemgale Plain. We handpicked sites which were in the closest proximity to one another and ended up creating two research polygons. Polygon No.1 consisted of 13 individual soil profiles and Polygon No.2 consisted of 12 soil profiles, all of them were situated in Platone municipality.

Visualization of polygons from each site representing depth of carbonates in the soil profile showed great variability. As regards Polygon No1, carbonates started at the depth of 71.6 cm (from 45 cm to 100 cm) on average. Concerning Polygon No. 2, carbonates started at the depth of 51.75 cm, respectively, with variations from topsoil to the > 100 cm. While carbonate spatial fluctuation is greater in Polygon No. 2 with standard deviation value σ_S – 32.4 cm comparing to the polygon No. 2 σ_S which had 20.6 cm. Carbonates have an impact on the soil pH values. The correlation coefficient had moderately strong positive linear relationship between $CaCO_3$ content and pH_{KCl} values with r – 0.66. As for $CaCO_3$ content in Polygon No. 1, it was 13.5%, with σ_S – 6.15, but Polygon's No. 2 average was 10.1% with σ_S – 8.33. Amongst all samples, clay content had moderate positive linear relationship with $CaCO_3$ content (r – 0.4), silt content had strong positive linear relationship with $CaCO_3$ content (r – 0.6), but sand content had strong negative linear relationship with $CaCO_3$ content (r – (-0.6)).

There were significant variations of carbonate content and its starting depth within the area of Zemgale Plain. Despite relatively homogeneous relief conditions and landscape, variations occurred in relatively short spatial distance. This soil feature might be of interest for land users taking into consideration that carbonates have substantial influence on soil physical and chemical characteristics, especially on bioavailability of some plant nutrients.

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INFORMATION TECHNOLOGIES

OPEN DATA FOR CYBER THREAT INTELLIGENCE

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In an era where cyber threats evolve at an unprecedented pace, leveraging open data for cyber threat intelligence emerges as a promising approach to bolster cybersecurity defenses. Recognizing the potential of open data in enhancing cybersecurity, we explore its application in threat intelligence, underpinned by the challenge of balancing accessibility with security.
The aim of this is to find the potential of leveraging publicly available data to enhance cybersecurity measures and threat intelligence capabilities.
There are several Open Data sources for cybersecurity solutions usage like Government databases (many governments release datasets related to cybersecurity threats, incidents, and vulnerabilities. Examples include the U.S. National Vulnerability Database (NVD)[1] and the UK's National Cyber Security Centre (NCSC) advisories [2]), international organizations (bodies like the European Union Agency for Cybersecurity (ENISA[3]) offer valuable data on cybersecurity trends and incidents in Europe), open source projects (projects like the Open Web Application Security Project (OWASP[4]) provide data on web application vulnerabilities), industry reports (some organizations release anonymized data on cybersecurity incidents and trends which can be invaluable for analysis). This perspective underscores the significance of open data as a resource for cybersecurity but also necessitates a framework to mitigate the risks associated with its openness.
But for better usage, we need to standardise open data structure, not only on the government side but also for private companies. Moon [5] has found that it is interesting to note that the concept of a standardized cybersecurity policy for civilian federal agencies has been identified and discussed at length in bi-partisan political circles for several years. Developing and maintaining a standardized interagency cybersecurity policy is extremely challenging and cumbersome. It could take years to fully implement, test, and perfect – potentially substantially longer than the establishment of a centralized data service.
In conclusion, we have some challenges at the national level, because not having open data at a national level, particularly in the context of cybersecurity, presents several challenges and risks. Open data can play a crucial role in cybersecurity by promoting transparency, enabling better risk assessments, and fostering innovation in defensive technologies. However, the absence of a national open data policy in cybersecurity can lead to fragmented and inconsistent data practices, reducing the overall effectiveness of cybersecurity measures across sectors.

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JAVASCRIPT SOURCE CODE FUNCTIONAL DOMAINS RECOGNITION USING SENTENCE EMBEDDINGS CLUSTERING

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Word embeddings as a source of code token representation have been widely used across different downstream tasks, e.g., function clone detection, code completion, and many others. The main difficulty in reusing already existing NLP methods from plain text processing for source code is that the source code contains rich syntax and structure information. Also, analysis methods and standards can differ for each programming language, as well as developers can have their own toolchain-specific logic and naming conventions. We tackle this problem by doing removal of programming language-specific keywords which makes code tokens more similar to natural language written sentences that can be embedded using sentence transformers. This can be beneficial for natural language written comments, source code identifiers, function names, and function parameters containing information about the source code domain. We use the CodeSearchNet dataset and SBERT to generate sentence embeddings for JavaScript functions and do K-means clustering of embedded data to form clusters of contextually similar sentences. The top 10 representative keywords are then extracted for each cluster using TF-IDF to evaluate functional domains covered in clustered sentences. To our knowledge, this is the first attempt to use sentence embeddings for JavaScript source code functional domain clustering and an important step to build models that can search and comprehend embedded code tokens based on source code functional domain [3].

In our experiment, 1000 clusters were selected as an optimal number of clusters using the *elbow* method. [2] Then subset cluster sampling was employed where 1000 produced clusters were the first stage and randomly selected 10 sub-clusters where sentences in each sub-cluster have minimum words >= 20 was the second stage. We sorted all keywords in the sub-clusters by highest TF-IDF to get the top 10 list and extracted sentences from the list that have at least two keywords. *Criteria* to evaluate functions that correspond to extracted sentences were the following: 1) if more than 50% of functions are contextually similar, we assigned value 1, otherwise 0; 2) if more than 50% of keywords are assigned correctly, we assigned value 1, otherwise 0.

Our approach performed with 70% precision for sentence assignments to clusters and 90% precision on clustered sentence keyword assignments. Results show that sentence embeddings combined with TF-IDF are reliable tools for function-representative keyword detection. We think that an important role in this success was programming language-specific keyword removal, which transformed function code tokens into natural language text which is more attractive to Sentence transformers that were originally made for text processing. Low results for sentence assignments to clusters could be related to the high dimensionality source code has and with the fact that code tokens still contain source code-specific lexicon that was not built into word embeddings. Alternative ways to encode source code-related text into word embeddings and experiments with different clustering algorithms we see as a potential future research direction.

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COMPARISON OF SEMANTIC SEARCH APPROACHES

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Understanding human language and its context has been a difficult job for computers until the last decade due to the semantic meaning of words and their context. Many fields in Natural Language Processing such as sentiment analysis, information retrieval, question answering, text translation, and text analysis depend on the level of semantic understanding of a language, and choosing a well-equipped algorithm may increase the performance in a specific field. The current research paper focuses on information retrieval (IR) and aims to find the best semantic search algorithm by comparing and evaluating retrieval approaches by implementing different word embedding methods in a vector search system.

According to [1] the term IR refers to 'finding materials of an unstructured nature that satisfy the need for information within a large collection typically stored in computers'. At the bottom, IR approaches can be lexical or semantic. Lexical is used to retrieve information by matching words or their variants, and semantic is used to retrieve based on the semantic meaning of words[2]. In general, semantic relationships between words are represented in a vector space using different embedding methods such as Word2Vec, GloVe, fasText, ELMo, and BERT [3]. The authors of this paper have used these state-of-the-art embedding methods along with a vector search engine called Milvus to perform IR operations in a dataset.

For the experiment, the authors used a dataset with question pairs and information about whether they are semantic matches for each other. Later, the data set was preprocessed, and tokens were embedded using pre-trained models of Word2Vec, GloVe, fasText, ELMo, and BERT. Finally, the embedded values of the tokens are placed in the vector space of milvus, and the cosine similarity is used to find the semantic relationship between them [4]. The closer they are in the vector space, the higher the possibility of having a similar meaning. The results are evaluated using recall, precision, accuracy, F-score, and graphs were created for all the evaluation criteria by changing the acceptable cosine distance to consider it as a semantic match.

In conclusion, by analysing the graphs, BERT outperforms all other algorithms. However, ELMo did not perform as it was predicted. In many cases ELMo was outperformed by GloVe and the author predicts that this could be because of the number of data used to train the model and the dimensions. The used ELMo model was trained using one billion words, while other models were trained using more words. Then the chosen ELMo model has a considerably larger dimension than others, so it may have worked as a diminishing feature. Further, this paper paves a path for future research in the use of semantic algorithms.

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CAPABILITIES OF OPENSTREETMAP DATA TO SUPPORT PRECISION BEEKEEPING

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Environmental research is crucial for understanding the complex interactions between human activities and the natural world. By exploring environmental data, scientists can identify potential threats to ecosystems, biodiversity, and human health, as well as develop possible solutions to nowadays challenges [1]. Such research is especially important for agriculture, including beekeeping, since it depends on natural resources and the availability of suitable areas [2]. One of the key factors in such studies is the availability and characteristics of the data.
The existence of open data makes it possible for researchers, businesses, policymakers, and other stakeholders to access, analyze, and enrich information. OpenStreetMap (OSM) data represents a collaborative and open-source mapping project that relies on contributions from volunteers worldwide who collect, edit, and update geographic information. The crowdsourced approach of an OSM enables the creation of highly detailed and up-to-date maps and spatial data sets that can be used for various purposes, including navigation, environmental planning, disaster response, and academic research [3]. Thanks to the availability and relevance of OSM data, it is possible to conduct a detailed analysis of the environment for agricultural branches, for which it is important to determine suitable areas for activity. One of the examples is beekeeping, for which the availability of necessary natural resources and the safety of the environment are important.
Within this research, the authors carried out a study of the OSM data to explore the capabilities of OSM data usage for agricultural needs, especially for precision beekeeping. During the study, methods for obtaining data as well as data properties were studied. Using Overpass API test data was obtained, a detailed analysis of their structure was carried out, and methods for their further processing were studied.
As a result, an experimental methodology was developed to obtain, classify, and analyze OSM data for potential use in precision beekeeping and agriculture in general. Potential risks affecting the accuracy of results when using OSM data were also identified and potential ways to reduce these risks were defined.

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USER EXPERIENCE (UX) DESIGN IN E-COMMERCE WEBSITES

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Due to the quick development of e-commerce technology and the growing popularity of online shopping, e-commerce websites have emerged as a crucial tool for businesses. User experience (UX) design is crucial for e-commerce websites since it has a direct impact on conversion rates and consumer happiness. Investigating how UX design affects consumer happiness and conversion rates in e-commerce websites is the goal of this study. This study explores the fundamentals and best practices of UX design, highlighting its significance in raising user engagement and boosting business growth by drawing on theoretical sources in the fields of e-commerce and UX design.

Using well-established studies in e-commerce and UX design, this study aims to offer practical advice to companies looking to enhance their online presence. According to Smith and Johnson (2017), improving UX design is directly related to higher conversion rates and higher customer retention. They emphasize the importance of simple navigation and seamless user journeys [1]. This study attempts to clarify workable methods for applying user-centric design concepts in e-commerce interfaces by looking at their findings.

Additionally, the paper explores Nielsen's (2000) research, which highlights the value of usability testing in iterative UX design processes [2]. The importance of user feedback and continual revision in maximizing the usability and efficacy of e-commerce websites is highlighted by Nielsen's ground-breaking research. Businesses can improve their UX design iteratively to better line with user expectations and preferences by using Nielsen's recommendations.

To sum up, the goal of this research is to present a thorough grasp of how UX design influences the success of e-commerce websites. It provides actionable advice for companies looking to use UX design as a strategic tool to increase user pleasure and achieve sustainable growth in the cutthroat world of e-commerce by fusing theoretical frameworks with actual data.

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BLOCKCHAIN PROTOCOL EFFICIENCY IN SUPPLY CHAIN AUTHENTICATION

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Modern technology has advanced to the point where it is normal, with systems, software, and applications changing rapidly. Particularly in the realm of supply chain authentication, developers strive to demonstrate how their solutions will enhance transparency and integrity. Blockchain protocols, integral to this process, have emerged as key components in ensuring the authenticity of products. With the increasing adoption of blockchain technology in supply chain authentication, its potential to revolutionize this sector is undeniable.

In today's tech-driven world, trust and efficiency are key in supply chain management. This article explores how blockchain technology, known for its transparency and security, can revolutionize the way products are authenticated [1].

We take a close look at three popular blockchain protocols Ethereum, Hyperledger Fabric, and Binance Smart Chain to see how well they handle product authentication. Using a real-life decentralized product authentication system as our guide, we tested and compared its performance [2].

Through our testing, we evaluate how fast these protocols process transactions, how well they scale with demand, and how cost-effective they are. Our findings shed light on the strengths and weaknesses of each protocol, helping supply chain experts make informed decisions about how to use blockchain to make their operations more transparent and trustworthy [3].

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RECOMMENDER SYSTEMS IN TOURISM: LITERATURE REVIEW

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Recommender systems in tourism are based on artificial intelligence algorithms that analyze data on user browsing habits to make custom suggestions on travel destinations, accommodations, and activities. These AI tools have become an integral part of the modern-day travel industry, necessitating the need to further develop the existing literature to fully understand their impact. This paper is a report of a deep analysis of the literature that was on these systems in the tourism domain, with an aim to provide a deep understanding of their functionality, strengths and limitations. The study also focused on identifying issues related to accuracy, biases, and data privacy, which are critical issues in AI systems used to process large amounts of user data.

To comprehensively explore recommender systems, the author used a mixed-method approach comprising a systematic review and a qualitative survey. The author began by assessing current systems, scrutinizing efforts made through research to enhance their performance, and then proceeded to conduct a survey to analyze features that enable them to correct sufficient relevant information required to make accurate recommendations.

The application of recommender systems in the tourism sector has significantly simplified the planning phase for travelers. According to Bulchand (2022), these systems analyze user interactions together with their preferences and historical patterns and use this data to offer personalized travel itineraries and suggestions with the aim of enhancing user experiences. However, the analysis showed that they are not without limitations. It highlighted persisting concerns regarding the accuracy of recommendations as well as potential biases in interpreting user preferences. There were also issues regarding the critical aspect of safeguarding user data and privacy (Zhang Mu et al., 2010). This research affirmed the hypothesis that recommended systems have evolved to become a cornerstone in modern travel planning. These systems have revolutionized how users explore destinations as well as accommodations and activities within different travel companies. They employ complex algorithms to deliver personalized recommendations based on users' preferences, past behavior, and historical data (Al Fararni et al., 2021). One area that has been greatly impacted by the use of these systems is the tourism sector. Within this sector, recommender systems have streamlined decision-making processes by providing tailored suggestions and options (Kontogianni & Alepis, 2020). It is essential to understand these concepts and aspects of recommender systems before embarking on any attempt to develop such a system. A compilation of current literature and insights from the qualitative survey inform the authors to make recommendations on approaches that can be applied and tested to augment the accuracy and precision of recommender systems in the tourism industry paving the way for the development of robust and user-friendly systems and serving as a foundation for innovation with the aim of integrating the best practices.

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A COMPARATIVE ANALYSIS OF DEEP LEARNING ARCHITECTURES FOR LIVE VIDEO CAPTIONING SYSTEMS FOR VISUALLY IMPAIRED PEOPLE

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Live video Captioning System (LVCS) possesses great potential in bridging the information gap for visually impaired individuals. This research analyses and compares three major Deep Learning architectures used in the LVCS development process by assessing their effectiveness in real-time captioning by all three architectures analysing BiLingual Evaluation Understudy (BLEU) scores with higher accuracy and efficient results.

Recently there has been an increasing amount of research studies on various Deep Learning approaches for live-time video captioning. Paper [1] proposes a system that mainly uses a Convolutional Neural Network (CNN) for extracting features and a separate Recurrent Neural Network (RNN) for generating captions. Paper [2] investigates an encoder-decoder framework with a 3D CNN: the encoder is used to capture spatiotemporal features from the live video and an LSTM decoder is used for caption generation. Whereas, paper [3] talks about Transformer-based architecture where self-attention mechanisms are used for both visual feature extraction and caption generation process.

The article provides a comparative analysis and evaluates the architectures mentioned above based on standard video captioning metrics like the BLEU score which takes into account caption similarity and the METEOR score which indicates semantic similarity. This analysis also evaluates the computational efficiency and processing speed of the architectures to figure out whether they are suitable for real-time applications.

Compared to the more complex architectures in papers [2] and [3], Paper [1] presents a simpler architecture that results in faster processing speed but lower caption accuracy. 3D CNN architecture which is used in Paper [2] could effectively capture spatiotemporal features, which also results in richer captions yet, the computational cost is higher than in Paper [1]. The transformer-based architecture used in Paper [3] demonstrates the best results in image captioning showing the better and higher BLEU score results which is way better than other architectural models in real-time application.

The main objective of this comparative-analysis paper is to identify and determine the advantages and limitations between captioning accuracy, processing speed, and computational efficiency existing in various Deep Learning architectures for LVCS. These results help in creating LVCS solutions that are better and more effective, therefore this will eventually result in greater accessibility for visually impaired individuals.

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AI-BASED INSULIN DOSAGE PREDICTION APPLICATION

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This article discusses using artificial intelligence (AI) to automate insulin treatment for type 1 diabetes, which is challenging due to unexpected events like eating meals. The proposed method uses a reinforcement learning (RL) algorithm to predict the optimal insulin dosage based on data collected from continuous glucose monitoring (CGM) and activity trackers.
The RL algorithm is designed to integrate data automatically using bio-inspired methods. It uses reward functions to set goals for glucose levels over time and adjusts based on individual pharmacological profiles using discount factors. This approach was tested using virtual patients in a simulator that mimics real-world conditions, including unscheduled meals.
Through training with RL, the algorithm learned to regulate insulin both before and after meals in a single-meal scenario. The method also provides interpretable insights into AI-driven decisions, such as handling sensor noise and avoiding issues like insulin stacking (where too much insulin accumulates).
The accuracy of this AI application was compared with traditional blood glucose monitoring methods to demonstrate its effectiveness.

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PUBLIC EDUCATIONAL INSTITUTIONS' WEBSITES COMPLIANCE WITH LATVIAN WEB REGULATIONS

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With the digitalisation process in education across the world come great challenges like types of devices and lack of mobile versions. European Union (EU) Digital Education Action Plan for the 2021-2027 period states that digitisation has transformed society and the economy, increasingly affecting everyday life. However, until the Covid-19 pandemic, its impact on education and training was much less [1].

According to regulation [2] accents for the need of regulatory compliance, website structure and content, accessibility and usability, information distribution, design consistency, and user engagement. However, if tested on an education website, it is typical to find that smaller educational institutions do not comply with said regulation. Usually, it is due to a shortage of staff with the competence to administrate a website or a lack of knowledge about the user experience (UX), interfaces (UI), programming skills, etc., but there is a significant need to analyse this topic more in the future. In 2014 research conducted by Layla Hasan found that only 1% of websites were considered top-tier in design, meeting age-appropriate web features across cognitive, effective, and design domains [3], [4].

It can be concluded that improving the website's transparency, reliability and trustfulness gives access to information more quickly and contributes to optimising staff workflow. The process of digitalisation in education, highlighted by the EU's Digital Education Action Plan and Latvian regulations, underscores the transformative impact of digital technology on the educational landscape. There is substantial room for improvement in the design and implementation of educational websites to better cater to diverse user needs.

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UNREGULATED DRONES AND THEIR IMPACT

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The purpose of this review is to comprehensively examine the various types of "robotic drones", also known as "Unmanned Aerial Vehicles" (UAVs), and their wide-ranging impacts on modern society. While these devices have become ubiquitous in the commercial and defense sectors, the rapid proliferation of various unregulated drone types, mainly due to advancements occurring at a pace at which the governments can't keep track of them constantly, poses significant challenges [1,2]. We first explore the key categories of commercial drones, such as hobby/consumer drones and modified/custom drones, including the ones that are retrofitted with militaristic features without appropriate permissions and have become much more accessible recently [3,4]. These devices, often equipped with advanced capabilities like cameras and other sensors, can have profound societal implications. We then delve into the multifaceted impacts of these intricate devices. Our key concerns include privacy and surveillance issues, as drones can enable unwarranted monitoring and intrusion into personal spaces [1]. Additionally, the uncontrolled operation of unregulated drones near sensitive areas like airports and other critical infrastructure can easily compromise public safety and national security [2,3]. We discuss how their use in creative industries has democratized remote imaging, while also highlighting the potential for misuse in stalking, smuggling, and sometimes even as improvised weapons. Furthermore, we highlight the economic and regulatory challenges posed by the rapid growth of the drone industry, which outpaces the development of appropriate policies and oversight [4]. Finally, a comprehensive understanding of their technical specifications is necessary for better regulation to be achieved [5]. The environmental and wildlife impacts of unregulated drone usage also need to be examined, emphasizing the need for a balanced approach to harness the benefits of drone technology while mitigating the inherent risks. In conclusion, we must underscore the critical need for proactive measures to address the burgeoning challenges associated with the proliferation of unregulated drone types. By drawing attention to their diverse impacts, we can emphasize the imperative of balanced policies and regulations to ensure the responsible and sustainable development of this new and highly transformative technology. Collaboration between policymakers, industry stakeholders, and end-users is essential to ensure the safe and responsible integration of the currently unregulated drone types into the societal landscape while avoiding conflicts.

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FORESTRY

MEDICINICAL PROPERTIES OF WELL-KNOWN TREES AND SHRUBS IN LATVIA

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Medicinal plants have a very long and rich history that finds its roots in ancient civilizations and early human society. This topic stems further into the era of modern medicine with a more complex understanding about biochemistry and chemical synthesis. The aim of this descriptive research is to continue to popularize the topic of non-timber values and their place in medicine, as well as terms related to active drug ingredients in trees and shrubs. The research is about such popular trees like *Pinus sylvestris* L., *Betula pendula* L., *Betula pubescens* L., and well-known shrubs *Vaccinium vitis-idea L., Vaccinium myrtillus* L. and *Oxycoccus palustris* L. *and Viburnum opulus* L.

The term "drug" when related to medicinal plants discusses specific parts of plants and their active ingredients, and how they can be used to create both traditional folk and modern medicines. The historically most well-known and analysed active ingredient groups include alkaloids, glycosides, essential oils, vitamins, etc [1]. Due to its wood properties, *Pinus sylvestris* is a highly economically important tree species, but it is also well known for its medicinal properties. The medicinal parts of *Pinus sylvestris* that are most commonly used include sap (*resina Pini*), buds (*gemmae Pini*), tar and needles (*acus Pini*). The buds contain a great amount of ascorbic acid, carotenoids, flavonoids, and essential oils of which the main ingredients are α-pinene and β-pinene. Both the buds and needles can be used to treat respiratory illnesses. Furthermore, when it comes to *Betula pendula* and *Betula pubescens* which are also economically significant trees. Medicinal drugs of *Betula pendula* and *Betula pubescens*. are the leaves, buds, sap, tar and charcoal. The sap and leaves are rich in vitamins and anti-inflammatory properties which can be used to treat respiratory illnesses. These are just a few of many other widely used medicinal tree species [1].

Moving onto medicinal shrubs such as *Vaccinium vitis-idea L.*, *Vaccinium myrtillus L.* and *Oxycoccus palustris L.* which all are used in a similar way, it should be noted that the chemical composition in them varies. Leaves and fruit from these shrubs are most commonly used to create medicinal drugs. The leaves of *Vaccinium vitis-idea* contain arbutin and carboxylic acids that have antibacterial properties. Fruit from Oxycoccus palustris contains a very high number of organic acids and B, C and P vitamins. *Vaccinium myrtillus* contains myrtillin which can reduce blood glucose levels. A slightly lesser-known shrub for its medicinal properties is *Viburnum opulus* due to it being used as a decorative plant. Medicinal parts of *Viburnum opulus* are the fruit and bark which can be used for women's health [2].

In conclusion, many plants have a long history for their medicinal usage that will continue to advance as we gain an even larger understanding relating to other illnesses and how this knowledge will become more available to the public. During this research it can be concluded that the most popular medicinal plants are based on the fact that they can help with respiratory and other more common illnesses, as well as hold a high amount of vitamin content, therefore most certainly there is a large potential of unexplored medicinal plants and their interaction with other ailments and fields of medicine.

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EUTROPHICATION OF STRENČI INLAND DUNE MASSIF

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Eutrophication is a natural process that causes aquatic and terrestrial ecosystems to change due to increase of nutrients like phosphorus and nitrogen [1]. Due to pollution and climate change, eutrophication has been increasing and endangering nutrient poor biotopes and landscapes. In Latvia, eutrophication mostly affects Scots pine (*Pinus sylvestris* L.) forests, because they tend to grow on poor soils [2]. In Europe eutrophication is considered one of the biggest threats to biological diversity, and it is a threat to biotopes like 91T0 (the code) - Central European lichen pine forests [3, 4].

In this study we tried to find how terrain affected eutrophication in *Cladinoso–callunosa* and *Vacciniosa* forests. To do this the study was conducted in Strenči inland dune massif, which is located in Valmieras Municipality. To study the vegetation and its projective cover of both forest types on the flat terrain and on dunes, twelve 20 by 20 metre square plots were created. Also four soil profiles were made to compare the soils in each terrain and forest type. To study the effect of eutrophication, vegetation species that were atypical or nitrophilous in each forest type were studied.

A total of 24 species were identified in all plots, of which 2 species were atypical to the forest types and 1 was nitrophilous. All the atypical and nitrophilous species were found on the flat terrain *Vacciniosa* forests, which also had the highest organic matter content in the soil. Flat terrain *Cladinoso–callunosa* forest soil had the highest phosphate concentration.

Flat terrain *Vacciniosa* forests were affected the most by eutrophication. *Cladinoso–callunosa* forests did not show any eutrophication indicators in vegetation, but showed increased phosphate in flat terrain soils. In order to better assess eutrophication and its effects, it is necessary to carry out more research in vegetation changes in these and other forests.

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FOREST FIRE CONSEQUENCES ON *PINUS SYLVESTRIS L.* SCOTS PINE

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Forest fires have a big impact on forests, especially on trees like Scots pine. It is important to understand how fires affect Scots pine forests, how they grow back, which trees survive, and how they continue to grow for effective management and conservation of forests.
Scots pine trees react to challenges such as fires and clearcutting. The aim is to understand how these trees adjust to changes in their environment caused by natural events and human actions by observing trees in the areas affected by both types of disturbances. Ultimately, the goal is to determine the effects of such events on the height and growth of Scots pine trees over time [1].
Following surface fires in oligotrophic pine forests, mortality rates among Scots pine can vary significantly, which is influenced by such factors as fire intensity and post-fire environmental conditions. Understanding how trees die in fires is crucial for managing and conserving forests in areas where fires are common.
The analysis of factors influencing Scots pine mortality after surface fires in oligotrophic pine forests suggests adaptive management strategies for forest regeneration and biodiversity conservation. We can better grasp the wider ecological effects of fire disturbances on forest ecosystems by studying mortality patterns in these forests [2].
Managing forests after fires is important for how Scots pine trees grow back in northwest Latvia. This is vital for restoring forests and making them stronger in areas that have been affected by fires.
It is crucial to assess how well these strategies work to help Scots pine forests to recover. By analysing different techniques used after fires, we can learn a lot about how effective they are in helping Scots pine trees grow back and restoring the overall ecosystem. This information is essential for making decisions based on evidence to reduce the impact of wildfires and ensure that forests can remain healthy in the long run [3].
To sum up, this research focuses on the diverse impacts of forest fires on Scots pine ecosystems, emphasizing the importance of proactive management strategies to improve resilience. It is important to combine what we know from science with practical methods to help forests become stronger and more resilient in places where fires happen often.

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AFRICAN SWINE FEVER IN LATVIA

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The wild boar population with African Swine Fever (ASF) threatens commercial pig farms and the economy of affected countries, with the disease still spreading in multiple countries despite intensive measures. The study using Latvian surveillance data found that implemented control measures had no significant effect on the virus prevalence or the proportion of hunted or found dead wild boar testing positive for ASF. The virus's persistence and the potential for an endemic situation in wild boar necessitate a reevaluation of current control measures [1].

ASF arrived in Latvia in 2014, primarily affecting wild boars and posing a constant threat to domestic pigs. The recent research shows an increase in seropositive and decrease in PCR-positive ASF cases, suggesting a potential decline in ASF incidence. This study analyzed Latvian ASF surveillance data from wild boar to estimate seroprevalence and ASF prevalence, revealing higher ASF prevalence in younger wild boar and higher seroprevalence in older animals. These results indicate that only a small number of infected wild boar survive, thus leading to an increase in their numbers over time. To eliminate ASF in Latvia, effective wild boar population management, surveillance, carcass removal, and a reduced wild boar population are crucial [2].

ASF has been detected in 851 wild boars in 2023, which means 20% increase from last year. Domestic pig holdings have also been affected, with 269 pigs eliminated across eight holdings. The head of the animal infectious diseases Surveillance Division, Mārtiņš Seržants, stated that ASF is actively spreading in the Vidzeme region and is a significant concern for domestic pig farmers, who must adhere to strict biosecurity measures [3]. To sum up, the situation is quite dangerous therefore strict measures to improve the situation are necessary.

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ESTIMATING FOREST STAND CHARACTERISTICS USING UNMANNED AERIAL VEHICLES

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Surveying forested areas for inventory purposes is a crucial, yet time consuming and costly process [1]. Traditional methods of forest mapping have faced limitations in terms of efficiency and expense. However, advancements in technology, particulary the development of small unmanned aerial vehicles (UAVs), have presented new opportunities for improving this process [2],[3]. UAVs offer distinct advantages over traditional manned aircraft, especially when it comes to surveying smaller areas [4].

The most common method for forest inventory data collection involves using an airborne laser scanning device (ALS) [4]. ALS is known for its ability to provide highly accurate data regarding tree characteristics [3], making it a valuable tool, particularly for national or regional scale [2]. However, ALS is not suitable for estimating tree species composition [3], [4]. In contrast, low altitude UAV imagery offers a promising alternative for observing certain forest characteristics [2] due to its ability to capture high – resolution data at a more detailed scale [3]. Canopy height measurements, for example, are crucial for estimating forest biomass, harvesting quantity and annual growth [2]. Nevertheless, dense forests pose challenges for obtaining accurate digital terrain models (DTMs) solely from UAV imagery. Consequently, DTMs must be acquired through other means to facilitate the derivation of canopy and vegetation height [3], [4].

Research papers have concluded that utilizing imagery generated by UAVs and LiDAR-derived terrain models (DTM) shows potential for estimating forest stand variables [2], [4]. Furthermore, the results indicate that UAV – based photogrammetry and hyperspectral imaging offer improved accuracy in tree species recognition compared to traditional aerial imagery. Additionally, these methods demonstrate comparable accuracy to ALS in estimating growing stock [3]. To sum up, the hi-tech solutions provides better opportunities for estimating forest stand characteristics with improved accuracy.

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NORWAY SPRUCE *PICEA ABIES* (L.) H. KARST. DEVELOPMENT OF PLANTING MATERIAL ON PEAT SUBSTRATE ENRICHED WITH BIOGAS DIGESTATE

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Peat is widely used for woody plants in Latvia, Scandinavia and the Baltic countries. Due to its structure, peat is a virtually indispensable material for growing trees. Peat is able to simultaneously provide the tree with the nutrients it needs, maintain a stable level of moisture in the soil and ventilate it in order to promote good tree growth, reduce the risk of soil drying out and ensure the exchange of water and air in the soil [2].

The Green Deal for 2019-2050 aims to reduce greenhouse gas emissions by recommending that forestry and other sectors reduce production of peat and peat products, on the grounds that peat oxidises immediately after it is harvested and releases all the CO2 it contains into the atmosphere. This is complemented by the European Climate Law proposed for 2020, which would ban all economic activity on peat bogs and require them to be rehabilitated. Therefore scientists are seeking alternatives to peat substrate. The solution to use peat and digestate substrate for tree growing as one option to achieve this objective is based on the research over the last decade.

The modern view of greening the environment attracts attention to the various by-products of industrial waste, where they can be used in soil improvement. The by-product of the biogas production process, digestate, contains the macronutrients needed by trees: nitrogen (N), potassium (K), phosphorus (P), magnesium (Mg), calcium (Ca), and the trace elements iron (Fe) and aluminium (Al). The use of these elements in tree cultivation improves root development, mass and vegetative organ growth, drought tolerance and overall maturation of the plant, thus contributing to faster and better quality tree growth [1].

In order to clarify the use of alternative substrates in the production of forest planting material, the research investigated different mixtures of digestate and peat substrate and how Norway spruce (*Picea abies* (L.) H. Karst.) would react to them. Seedlings, framework seedlings and bare-root seedlings of Norway spruce with improved root systems were examined to give an idea of the effectiveness and future applications of the research.

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BIODIVERSITY IN URBAN FORESTS

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Urban forests have a significant importance in the context of rapid urbanization and climate change. Urban forests are vital green infrastructures that contribute to biodiversity and climate conservation, and the enhancement of urban residents' quality of life.

The importance of urban forestry has been recognized by various leading international institutions and their adopted reports and declarations, highlighting the value of ecologically sustainable urban planning and development, as well as acknowledging the key role of nature and green spaces in enhancing cities` resilience and urban life quality [1].

Over a half of the world's inhabitants currently reside in urban areas. With the pace of urban expansion accelerating like never before, it is projected that by the middle of the 21st century, nearly two thirds of the global population will inhabit urban centres. The durability of ecosystems benefits from urban forests depends on a mix of species, their diversity, age, and structure. Different trees offer varied services based on their specific traits, with certain trees specializing in particular ecosystem functions [2].

Locating areas for tree planting within urban centres can pose significant difficulties, with entire areas where it is impractical to plant trees, necessitating alternative strategies. For instance, using walls and roofs as the sole options for adding greenery [3].

Urban forests are increasingly recognized for their critical role in prompting biodiversity, climate conservation, and enhancing the quality of life for urban residents amid rapid urbanization and climate change. With over half of the world's population living in urban areas (a number that is expected to rise significantly) urban forests offer essential ecosystem benefits. However, the challenge of finding suitable locations for tree planting in densely populated urban centres often requires innovative approaches.

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FOOD SCIENCE

COMPARISON OF POWDERED MORINGA OLEIFERA FROM DIFFERENT ORIGINS

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Moringa oleifera, also known as the drumstick tree or horseradish tree, is a fast-growing tree that is native to India and grows in tropical and subtropical regions of the world. Moringa is known for its high nutritional value, and every part of the tree is suitable for either food or commercial purposes [1]. The leaves of Moringa oleifera are rich in antioxidant chemicals, minerals, proteins, and β-carotene. Additionally, they are also known for their high vitamin C, A and E content. Due to their high protein content and many vitamins and minerals, moringa leaves are a popular option for people looking for nutritional supplements. Incorporating moringa into your daily routine will provide you with a high nutritional content that can improve your overall health and well-being [2]. The aim of the current study was to compare the composition of Moringa oleifera powder from India and two samples available in Latvia.

The three Moringa oleifera samples were tested: A - Moringa leaves collected and dried in India (Kerala, South India), B - commercial sample available in Latvia, originating from India (MIPAMA E.Z Szafarz sp.j., Lenkija/Polija), C - commercial sample available in Latvia, originating from Egypt (Smart Organic AD, Bulgaria). The samples (0.5 g) were extracted with 25 ml of solvent (ethanol+H2O+HCl) and the extracts were analysed for total phenols, antioxidants, flavonoids. Chlorophylls a, b, carotenoids were extracted with 20 ml acetone and the filtered extract was analysed by UV/Vis. The volatile components were determined with GC/MS and the colour of the powder with a colorimeter.

The highest content of chlorophyll a was present in sample C and chlorophyll b was strongly represented in both sample B and sample C. The concentration of flavonoids was higher in samples A and C than in sample B. Samples B and C have the highest peak area of volatile compounds. The colour intensity is higher in sample A than in the commercial samples B and C. The composition of Moringa oleifera powder is different, and the samples available in Latvia showed a high content of bioactive substances.

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EFFECT OF PASTEURISATION ON VOLATILE COMPOUNDS FOR CALORIE-FREE, CARBONATED PEPPERMINT (MENTHA PIPERITA L.) TEA

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The aim of an economically sound and innovative beverage is to maintain its safety throughout the marketing period, which can be achieved through heat treatment, respect for good hygiene and manufacturing practices, the maintenance of maximum biological nutritional values and appropriate sensory properties. At elevated temperatures, there is a possibility that sensory properties and biological nutritional value change significantly during tea pasteurization, so it is necessary to carry out an in-depth examination of what changes occur after pasteurization in the volatile compound composition [1].

In the case of the study, peppermint (*Mentha Piperita L.*) tea before and peppermint tea with steviol glycosides-based sweetener after pasteurization was analyzed using gas chromatography solid Phase micro-extraction (SPME) with polymer fiber "DVB/Carboxen™/PDMS StableFlex™" with a pore size of 50 μm X 20 μm. The peppermint tea was made using organically grown peppermint leaves from Dobele municipality, Krimūna parish. The oven was heated at an initial temperature of +40 °C lasting 7 mins, after which the temperature was raised at an increasing rate of +7 °C min^{-1} to reach +160 °C, after reaching this temperature the increasing rate of temperature was applied at +10 °C min^{-1}. The volatile compounds were identified using the results of the NIST MS Search 2.0 program.

The aim of the study was to compare results of volatile compound composition and integral values before and after pasteurization, additionally, raising hypotheses of reaction mechanisms during the process of heat treatment.

1 methyl ketone (acetone), 2 monoterpenes (L-β-pinene and L-limonene), 1 terpenoid (eucalyptol), 2 monoterpene ketones (menthone and D-menthone), 1 acetate ester (menthol acetate), monoterpene alcohol (neo-menthol and L-(-)-menthol) were identified. Before pasteurization, L-(-)-menthol was identified in mint tea, which made up more than ¾ of all volatiles indicating that monoterpene alcohols, i.e., various menthols, predominated (83.9%). Meanwhile, after pasteurization total monoterpene alcohols accounted for less than half (46.8%). As for integral value comparison, an increase was observed after pasteurization for all volatile compounds, except for menthones and L-(-)-menthol. Hypotheses were raised for reaction mechanisms – menthol to menthone oxidation, pinene to acetone oxidation, pinene to limonene synthesis, L-menthol to L-menthol acetate catalyzed by acetyl transferase.

Further research and a more precise methodology with a lower probability of error are needed to confirm the reaction mechanisms mentioned in the study. Pasteurization has an impact on the composition of volatile compounds, but further repetition is needed in order to ascertain by static means whether there is a significant difference between the samples in volatile compounds before and after pasteurization, and whether these changes can be perceived by the consumer.

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ANALYSIS OF SAFETY PARAMETERS IN THE STUDY OF *TENEBRIO MOLITOR* LARVAE AS SUBSTRATE USING BY-PRODUCTS

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The rising global demand for animal-based foods has led to a progressively harmful ecological impact, exacerbated by the substantial food waste that accounts for approximately one third of all food [1,2]. This study aimed to investigate whether it is possible to replace conventional balanced feeds with sustainable alternatives derived from by-products of agriculture, grain processing and brewery production in order to promote agricultural sustainability [3]. The reluctance to include mealworms in Western cuisine can be attributed to cultural biases, perceived risks, and safety concerns, compounded by a lack of comprehensive research on the potential dangers of insect consumption, such as the presence of contaminants [4,5]. Our hypothesis is that if we cultivate mealworm larvae using by-products generated from brewing and grain processing, grain processing and agricultural products, the resulting level of contaminants in the mealworm larvae would be low and would not pose a safety risk to the end product. The mealworm larvae were reared on different substrates: 1) agar-agar gel, wheat bran and brewer's yeast; 2) carrots, wheat bran and brewer's yeast; 3) sprouted potatoes, wheat bran and brewer's yeast; 4) carrots, brewer's grains, and brewer's yeast. The entire study can be easily repeated, as the tests were carried out in accredited laboratories.
The results showed that all samples tested had pesticide levels below the detection limit. The larvae showed no significant accumulation of these toxins (the sum of benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and chrysene was 0.0007 mg/kg). The concentrations of heavy metals, such as chromium, were highest in the sample containing the by-products of the brewery (1.45 ± 0.02). Of all glycoalkaloids, the highest amounts of α-solanine and α-chaconine were found in the sample with sprouted potatoes (175.12 ± 0.21 and 139.32 ± 0.32 mg/kg, respectively). The total amount of putrescine, tyramine, spermine and spermidine in mealworm larvae was statistically higher than that in the substrate, while histamine levels were significantly lower. Despite the toxic substances in the substrate originating from by-products, the study suggests that the mealworms do not accumulate high levels of toxins that would violate regulations. However, there are still concerns about the elevated concentrations of particular chemical toxins, which, although present in small amounts, can still have a real impact on health.

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THE INFLUENCE OF VARIOUS WINE YEAST STRAINS ON THE PHYSICOCHEMICAL PARAMETERS OF CRANBERRY - HONEY WINE

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Honey wine is a historical drink made only from honey and water. Information on fruit honey wines is most frequently found, which indicates a significant trend in the honey wine consumption of honey wine. No special production technology is described for honey wine; anyone can make it. In traditional honey wine, only diluted honey is fermented, but there are different types of honey wine in which various other ingredients are added during preparation. Different fruits or their juices (fruit honey wine), different spices, can be prepared with apples or grapes. The physicochemical parameters of the various honey wines depend on the raw materials used. If no other ingredients are used, the chemical composition of the honey (and therefore the ethanol content) has a direct effect on the chemical composition and organoleptic properties of the wine. The chemical composition and flavour compounds vary depending on the type of honey and where it is harvested. The yeasts selected also have a significant influence on the composition of volatile compounds and physicochemical indicators in the wine. The most commonly used yeast strains are isolated from the species Saccharomyces cerevisiae. The aim of the current research was to evaluate the influence of different wine yeast strains on the physicochemical parameters of cranberry-honey wine.

The study compared the influence of 3 different yeast strains (Saccharomyces cerevisiae strains Lalvin EC1118, Lalvin K1-V1116, Mangrove Jack's Mead yeast M05) on the physicochemical parameters of cranberry juice-honey wine. Physicochemical methods were used to understand their effect on cranberry honey wine: Determination of pH, determination of density using a hydrometer, determination of titratable acidity, determination of alcohol content using an alcoholometer and determination of aroma compounds using a gas chromatograph. The analyses were carried out on days 0, 12, 17 and 24 of fermentation.

The fluctuations in pH during the fermentation process were similar for all yeast strains, which can be explained by the biochemical processes during fermentation. Significant differences between pH and density indicators were not observed in the tested cranberry honey wine samples, while titratable acids were more pronounced in samples with yeast strain EC1118 and a higher alcohol content was observed in samples with yeast strain K1-V1116, which could be explained by the influence of fermentation conditions on the yeast strains, where conditions were unfavourable for strain EC1118 but favourable for strain K1-V1116. The presence of benzoic acid in the cranberry juice impaired the activity of the yeast, as the target concentration of ethyl alcohol was not reached. The alcohols determined in the samples were isopentyl alcohol, octanoic acid and caprylic acid ethyl ester. The lowest ethanol content and more other compounds were found in samples with the yeast strain K1-V1116, which is also consistent with the literature. In contrast, the composition of volatile compounds in yeast strain M05 did not match the literature.

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SENSORY EVALUATION OF INNOVATIVE ENERGY DRINKS BASED ON SPRUCE SPROUT, FRUIT JUICE AND COLD BREW COFFEE

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The Food and Drug Administration (FDA) defines energy drinks (ED) as sodas that contain high levels of caffeine and sugar, which can lead to various health problems. In addition to caffeine, stimulating substances such as taurine, L-carnitine, and guarana may also be added. An increase in the consumption of energy drinks has been observed in the 18+ age group [1]. Spruce sprouts are not a new ingredient in food production. Research shows that spruce sprouts have many health benefits [2]. This study research aimed to produce a consumer-friendly energy drink based on cold-brewed coffee, spruce sprouts, and fruit juice.

A sensory sample evaluation was carried out to determine consumers' preference for consumer-friendly energy drinks. Forty people participated in the sensory evaluation, including 29 men and 11 women in the 22 to 35 age group. For the sensory evaluation, 6 energy drinks were prepared to contain different amounts of added spruce sprout juice (3.2 or 6.4%), fruit juice (orange or apple-aronia), and cold-brewed coffee made from medium-roasted coffee beans from Lofberg. The sensory evaluation method used was the Just About Right (JAR) method, in which appearance (colour), fruit aroma, coffee flavour and aftertaste were analysed. An arrangement test was carried out in which consumers had to rank the drinks according to their taste on a scale from 1 (the most unappealing) to 6 (the most appealing).

The study research showed that the appearance (colour) and coffee flavour of energy drinks with 3.2% spruce sprout juice using the JAR method was right. But the fruit flavour and after-taste were just right for energy drinks with 3.2 and 6.4% spruce sprout juice using the JAR method. The results of the arrangement test showed that drinks with 3.2% spruce sprout juice had a more pleasant taste compared to energy drinks with 6.4% spruce sprout juice.

In conclusion, out of the 6 EDs, 3 EDs with the best properties were selected. One with 3.2% spruce sprout juice and cold-brewed coffee, the second with 3.2% spruce sprout juice, cold-brewed coffee, and orange juice, and the third with 3.2% spruce sprout juice, cold-brewed coffee, and apple-aronia juice. This suggests that it is possible to produce consumer-friendly ED substitutes using more natural ingredients. For further analysis of the prepared samples, the bioactive compounds and storage.

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VETERINARY MEDICINE

PREVALENCE OF ECTOPARASITES IN POPULATIONS OF MUTE SWANS (*CYGNUS OLOR*) AND WHOOPER SWANS (*CYGNUS CYGNUS*) IN THE TERRITORY OF LATVIA

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Ectoparasites are external parasites that use the hosts' organism both as a source of food and as a place to live which often leads to negative effects on the host they parasitize. Ectoparasites can be intermediate hosts for endoparasites and if in high number, can reduce the bird's quality of life [1,2]. The research specifically is focused on chewing lice *Mallophaga* [3]. These parasites mostly feed on bird feathers and dead skin cells; some species also feed on blood.
The aim of the research is to find out the prevalence of ectoparasites in swans in the territory of Latvia.
Parasitological plumage examination was performed macroscopically and microscopically in 4 parts of the body - head, neck, back and wings. It was done in a wild bird rehabilitation centre in the period from 2020 until 2022. If during the visual inspections parasites were detected, then samples were collected and examinated microscopically.
A total of 63 swans were examined in the study, of which 60 were mute swans *Cygnus olor* and 3 were whooper swans *Cygnus Cygnus*. Ectoparasites were found in 24 swans. Of the examined birds, 23 (38.3%) mute swans (n=60) and 1 (33%) whooper swan (n=3), were positive for the presence of ectoparasites. Of the 16 clinically healthy swans, ectoparasites were found in 2 of them (12.5%), but in the examined 43 sick or injured swans, ectoparasites were found in 22 (51%). 4 swans are not included in the calculations because their health status is unknown. Based on morphological examination, samples were differentiated into 4 genus - *Ornithobius* spp., *Anatoecus* spp., *Pseudomenopon* spp., *Trinoton* spp.
In conclusion, the prevalence of ectoparasites was calculated in the examinated swans (38%). It was found that the animal health status is a significant factor ($P<0.05$) for ectoparasite infestation. It should be taken into account that a large proportion of all the birds examined were not clinically healthy, which significantly affects the prevalence of chewing lice in birds. The prevalence of chewing lice in the whooper swan population cannot be judged by the results obtained in the study, because the number of animals in the investigated group is too small. Swans with a high number of ectoparasites can be more prone to endoparasites, like heartworms *Sarconema eurycerca,* whose intermediate hosts are *Trinoton* spp.[2].

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CORTISOL CHANGES DURING LAPAROSCOPIC AND OPEN OVARIECTOMY IN BITCHES WITH THE SAME ANESTHESIA PROTOCOL

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Most of the authors highlight the main advantages of laparoscopic neutering procedures compared to the open ones, lower trauma and lower number of postoperative complications. There are only a few publications evaluating the systemic effects during pneumoperitoneum (PNP) in the laparoscopic neutering procedures compared to the open techniques [1]. The aim of this study was to evaluate the systemic effect of PNP by measuring cortisol concentration in blood serum during laparoscopic and open OVE in bitches with the same anaesthesia protocol. The research was done at Lithuanian University of Health Sciences (LUHS), Veterinary Academy (VA) Dr. L. Kriauceliunas small animal clinic from September 2023 to February 2024 and was approved by the Ethics Committee of LUHS VA. The inclusion criteria for this study were clinically healthy (ASA I), younger than 5 years old female dogs admitted for neutering procedure. The included animals, based on the owner decision, were divided into two groups depending on the surgical technique: laparotomy OVE group (I grp. n=9) and laparoscopic OVE group (II grp. n=9). Anaesthesia protocol for both groups dogs was the same: premedication with methadone hydrochloride 0.5 mg/kg (Insistor 10 mg/ml, Austria) and dexmedetomidine hydrochloride 3 mcg/kg (Dexdomitor 0.5 mg/ml, Finland) iv, induction with propofol 2-4 mg/kg (Propoven 10 mg/ml, Netherlands) iv till the effect, anaesthesia maintenance with sevoflurane (vaporizer setting 2%) (Sevorane, Italy) in O_2 100%. All animals were infused with NaCl 0.9% iv infusion at 5 ml/kg/h rate. Postsurgical pain control was achieved with buprenorphine hydrochloride 0.015 mg/kg (Bpaq Multidose 0.3 mg/ml, Austria) im and meloxicam 0.2 mg/kg (Inflacam 5 mg/ml, Ireland) sc. For cortisol evaluation blood samples were collected from *v. jugularis* before premedication (T0), after abdominal incision in I grp. and before PNP in II grp. (T1), before suturing abdominal wound in I grp. and before PNP deflation in II grp. (T2) and 2h after the surgery (T3). Cortisol concentration was measured with FUJIFILM DRI-CHEM IMMUNO AU10V (FUJIFILM Corporation, Japan) analyzer with normal ranges 0.2-5.9 mcg/dL. Statistical analysis was done with SPSS 29.0 software by assessing median, minimum and maximum values, p values were counted by Mann-Whitney U test. The differences were considered statistically significant when $p < 0.05$.

The median of I grp. dogs age was 24 [8-72] months and weight 10.7 [2.8-23.8] kg. The median of II grp. dogs age was 24 [7-60] months and weight 9.5 [6.2-19.5] kg. Cortisol concentration at T0-T2 between I and II grp. animals was not statistically significant different. The median of cortisol concentration at T0 was I grp. 6.65 [1.02-14.61], II grp. 4.90 [0.1-15.90] (p=0.387), at T1 – I grp. 5.45 [0.72-9.04], II grp. 4.72 [0.32-9.10] (p=0.931), at T2 – I grp. 10.11 [4.64-21.94], II grp. – 5.78 [0.1-10.47] (p=0.077). At T4 cortisol level was 2.3 times higher in I grp. dogs whan in II grp. (I grp. 7.62 [3.89-29.17], II grp. 3.22 [0.1-10.08] (p=0.004)).

According to the study, data there was found no impact to cortisol changes during laparotomy or laparoscopic OVE in bitches with the same anaesthesia protocol. There was found that surgical technique had an impact to cortisol concentration after two hours after the surgery, which for laparotomy OVE was 2.3 times higher compared with laparoscopy OVE.

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INSULIN DYSREGULATION AND LAMINITIS IN CLINICALLY HEALTHY, OBESE HORSES AND PONIES

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Obesity predisposes horses and ponies to various clinical conditions, including insulin dysregulation followed by endocrinopathic laminitis, together described as equine metabolic syndrome. Though characteristics of laminitis in these cases can sometimes be seen radiologically when only minimal clinical symptoms are present, it often goes unnoticed and is diagnosed only when severe clinical symptoms and debilitating disease with often lethal outcome has started, thus acknowledging risk factors of this disease and performing timely diagnosis is crucial. [3] There are several methods used for diagnosing insulin dysregulation but dynamic oral sugar test, using corn syrup, is one of the most widely used in clinical practice [1]. Laminitis is diagnosed based on clinical signs and visual diagnostic using radiography. [2] The aim of this study was to find out if clinically healthy, obese horses and ponies show signs of insulin dysregulation and if these horses have changes in radiographic images of hooves associated with laminitis.

In order to perform this study, study group that consisted of 10 horses and 10 ponies at the age of 5-17 years, with no history of laminitis or endocrinopathic disease and with body condition score ≥ 7, were chosen. Oral sugar test, using Karo corn syrup at the dose of 0,45 ml/kg was performed, and insulin and glucose levels in venous blood samples were determined before, 60 and 90 minutes after feeding Karo syrup. Additionaly two radiographic projections, lateromedial and dorsopalmar, of both front hooves were performed.

Insulin dysregulation at the time of the test was confirmed in two horses. One of the horses showed basal hyperinsulinemia and inadequate insulin release after feeding Karo syrup, while the other horse showed high insulin levels only after feeding Karo syrup. In all horses and ponies peak insulin was seen at 60 minutes after the Karo syrup.

Changes associated with laminitis in radiological images were seen in four horses. Two of which were the same ones that showed signs of insulin dysregulation, the other two showed normal insulin and glucose levels thorough the test. No ponies showed insulin dysregulation or laminitis associated changes in hooves.

The results of this study suggest that insulin dysregulation and changes in hooves associated with laminitis in some cases can be present in horses with no apparent clinical signs. Furthermore, the results of this study suggests that insulin sensitivity can be changing and negative results should not be taken as definite.

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ULTRASONOGRAPHIC EXAMINATION OF CANINE GALLBLADDER MUCOCELE: AN ANALYSIS

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Gallbladder contents are a common finding when imaging canine gallbladders, with up to two-thirds of dogs having gallbladder debris. The clinical significance of gallbladder sediment varies widely, with small amounts of sediment often being an incidental finding. Conversely, gallbladder mucoceles have been associated with gallbladder rupture, emergency, and high rates of morbidity/mortality [1]. The ultrasonographic classification of gallbladder mucocele in dogs has evolved since it was first described more than 20 years ago with 6 types of gallbladder mucocele based on unique ultrasonographic patterns. In the retrospective cohort study carried out by Jaffey JA *et al*., it was found that dogs with higher gallbladder mucocele type were more likely to exhibit signs of biliary tract disease [2,3]. The primary objective of this thesis was to assess the efficacy of ultrasonographic examination in diagnosing canine gallbladder mucocele. The analysis conducted from 2018 to 2023 encompassed 66 dogs of diverse breeds, sexes, weights, and ages. The patients were diagnosed with gallbladder mucocele based on their anamnesis, clinical signs, blood biochemistry, and data from the ultrasonographic examination of their hepatobiliary system. During the ultrasonographic examination of the hepatobiliary system, the echogenic content of the gallbladder, wall thickness, and diameter of the common bile duct were evaluated. Subsequently, the gallbladder mucoceles were classified into six types, and the degrees of ultrasonographic changes in the gallbladder were quantified.
The majority of the patients (53%) were male. The average age was 9.65 ± 2.94 years, and the average weight was 9.6 ± 9.25 kg. The most prevalent clinical sign was vomiting, which was diagnosed in 41% of the patients and painful or distended abdomen which was diagnosed in 27.27% of the patients. The analysis revealed that dilation of the common bile duct was diagnosed in 56% of the dogs. The most frequently observed types of gallbladder mucocele were type I (51.51%) and type II (36.36%). The distribution of the degree of gallbladder ultrasonographic changes followed a Gaussian pattern.
Based on findings of this retrospective study it is concluded that a positive correlation was observed between patient age and the degree of gallbladder ultrasonographic changes, between age and blood serum ALP concentration, between blood serum ALP concentration and gallbladder mucocele type ($p<0.05$). There hasn't been found any association between presence of clinical signs and gallbladder mucocele type ($p>0.05$).

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PHYSICAL EFFORT, FUR, AIR AND DEEP-BODY TEMPERATURE INFLUENCE ON EUROPEAN BISON'S (*BISON BONASUS)* WATER METABOLISM

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European bison inhabit environments with temperatures oscillating from - 40°C to + 40°C. The goal of this research is to understand how fur, physical effort, air, and deep-body temperature affects bison's water metabolism.

Our hypothesis are the following ones: body parts with denser fur are certainly the most insulated ones, physical activity increases the deep-body temperature, and we predict that when air temperature increases, water metabolism increases and vice versa.

To find what are the more or less insulated body parts and where are insulation's lacks, we took thermal pictures with a Canon 222 camera, 3 meters away from the bison. As measures were taken 15 days apart, we assume that fur was identic and that bison's surface temperatures measured by the camera were only impacted by air temperature.

To assess water metabolic rates, we measured the feces dry/wet matter ratio under varying air temperature. We collected twice four samples of 40g of feces at Thoiry zoo (France). Feces dried at 70°C for 8 hours to obtain the dry mass in order to calculate the ratio. For the experiment, bison were clinically healthy and fed with the same fodder. Feces were fresh from the night. They were collected at 10 am in two different temperature conditions (-3°C and +12°C).

Thermal imaging identified the neck, the back and the belly as the most insulated body parts (they represent 60% of the body). The eyes, mouth, horns, side parts of the body and legs showed lower insulation.

During cold times, fur provides heat conservation, but when deep-body temperature is high, it prevents heat from escaping and makes the deep-body temperature increase. That explains why rectal temperature increases by 1°C when air temperature rises by 17.8°C and that a 30 minute run makes rectal temperature reach 41.75 ± 0.8°C [1].

Body parts with higher hair weight and density shows better insulation: shoulder's clean weight is 43.56 ± 2.39 mg/cm2 while rib's hair clean weight is 53.84 ± 2.71 mg/cm2 [2], humerus' skin temperature is 36 ± 0.65°C while abdomen's is 36.73 ± 0.4°C [1]. This data gives us good reasons to assume that hair weight is correlated to body part's temperature and so, to heat loss in air, even if confidence intervals overlap.

On 9/01, it was -3°C outside and faces contained 45 ± 2.5% of dry matter. On 24/01, it was 12°C outside and feces contained 20 ± 1.8% of dry matter. Our findings support that air temperature influences water metabolism: dry/wet matter ratio halves when air temperature rises by 15°C. When air temperature increases, bison's deep-body temperature increases, and sweating process activates, therefore, bison lose a part of their water and feces become drier.

These results show the influence of different factors on water metabolism. Research can be deepened by adding a wider range of air temperature a larger number of specimens.

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RESEARCH ON THE EXPRESSION, DETECTION, AND ASSESSMENT OF ESTRUS CRITERIA IN LIMOUSIN AND ANGUS CATTLE BREEDS TO ENHANCE REPRODUCTIVE PERFORMANCE

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In beef cattle herds, maintaining a 12-month calving interval is crucial, necessitating a shortened service period for cows. The window for pregnancy after calving is 65 to 85 days, with approximately 35-40% of cows exhibiting "silent" estrus, making visual observation challenging. Despite advancements in reproductive physiology knowledge and estrus detection aids, detecting estrus remains a major challenge, especially in beef cows with longer non-estrus periods.

This study focused on investigating differences in the first heat after calving among various beef cattle breeds. Specifically, the research examined 50 Angus and 50 Limousine cows, monitoring reproductive parameters such as estrus duration, timing of the first post-calving estrus, activity levels, internal body temperature, and estrus index.

Estrus detection utilized multiple methods, including direct visual observation three times daily and digital boluses incorporating physical activity and temperature measures. The SmaXtec boluses were administered orally to all cows at the study's onset. Data were recorded through the SmaXtec messenger® software.

Results showed that 76% of cows were identified as in estrus within 85 days post-calving, aligning with the goal of achieving a 365-day calving interval through insemination within this timeframe. The digital bolus system identified estrus in 30% of cows between 22-33 days, 30% between 34-57 days, and 16% between 58-85 days. Visual observation, however, missed 70% of first estrus events due to low cow activity.

During the research, it was observed that Angus cattle had an average activity level of 19 units, compared to 17 units for Limousin ($p<0.05$). The system calculated a Heat Index (HI) based on activity and temperature data, reflecting estrous intensity. The initial post-calving HI was higher for Angus (HI=84) than for Limousin (HI=74). Furthermore, Angus cattle had a lower average body temperature over 7 days (39.08°C), which increased by 0.47°C during estrus, compared to Limousin cattle, which had a higher average (39.33°C) and a 0.41°C increase during estrus ($p<0.05$). The average estrus duration was established at 15 hours, with Angus re-entering estrus post-calving after 54 days and Limousin after 58 days.

The study evaluated the sequence of estrus signs across different cattle breeds, revealing more pronounced signs in Angus cattle. The applicability of physical activity and temperature monitoring systems for optimizing breeding timing across breeds was assessed. The adoption of these new technologies has the potential to enhance insemination efficiency, reduce labor, and cut costs compared to traditional visual observation. Additionally, the study found that the service period could be shortened by earlier detection of initial estrus signs and commencing insemination sooner.

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ADIPOSITY-PROMOTING FACTORS IN NEUTERED CATS

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Nowadays obesity in animals as well in humans is a very common problem. 2022 statistics from the Pet Obesity Prevention Association shows that 61% of cats are overweight or even obese. Obesity is an excessive accumulation of fat that can be divided into two stages: overweight, if the cat's body weight is above 10% of the normal weight, as well as obesity, if the body weight exceeds 20% of the optimal. This excessive accumulation of fat can create additional risk of contracting various diseases, such as heart disease, diabetes, joints and internal organs suffer. These days, among cat owners, castration of their pets is very popular. Castration is one of the most common surgical operations in veterinary medicine, which involves removing the genitals. One of the most common consequences of castration is obesity so it is important to be aware of the risks of adiposity and avoid adiposity – promoting factors [1,3].

The aim of this study was to find out the incidence of adiposity in neutered and non-neutered cats, as well as factors contributing to it.

Hypothesis: Adiposity is more common in neutered cats than in non-neutered cats.

The main tasks were to explore the latest findings on adiposity in cats, to find out the incidence of obesity in cats and to find out the factors contributing to adiposity in cats and compare with the factors described in the literature.

The questionnaire was conducted from February 13, to February 21, 2024 on the platform www.visidati.lv. The questionnaire was distributed on social sites ''Instagram'' and ''Facebook'' as well as on the instant messaging app ''WhatsApp''. 192 respondents took part in the survey, who anonymously answered 20 questions, which were divided into several groups: general information about the cat (castration, age, sex, etc.), exercise level, type of food and frequency of feeding, influence of the external factors, as well as the owner's personal assessment about the cat body condition on the scale of 1-5 according to the pictures. As the last question, informative feedback was added about the risks of obesity and the desired weight range for the most common cat breeds in Latvia.

The research proved that castration of cats is widespread in Latvia, because out of 192 respondents, 174 were owners of neutered cats, and 18 were not neutered. In this study, the age risk category matches with that described in the literature [2]. Obesity was the most common at the age of 5-11 years, where the most common age was 8 years. As the castration age may affect risk of obesity, it was divided into 3 groups: castration before 6 months, 6-12 months and after 12 months. Most cats were neutered in the age category of 6-12 months, in which 30,5% of cats were overweight. The results about the cat's weight were compared with owners' subjective opinion about the possible obesity of the cats as well as with the assessment of the cat's body condition scale. It was proved that the subjective opinion of cat owners is a significant risk factor in the development of obesity in cats.

The hypothesis was confirmed, because in the risk category (5-11 years) neutered cats had adiposity in 56% of cases, while in non-neutered cats in 33,3% of cases.

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COMPARATIVE ANALYSIS OF PATHOGENS IN FOUR LEVELS OF PERIODONTAL DISEASE IN DOGS

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Periodontal disease is one of the most prevalent oral inflammatory diseases in dogs significantly affecting overall health of dogs. This research aims to elucidate the differences between the pathogens present at various stages of periodontal disease in Lithuania.
Specimens were taken from the periodontal pockets of 108 teeth in 29 canines, aged between 1 and 15 years, all procedures were performed under general anesthesia. A comprehensive identification of bacteria up to the species level across all four stages of periodontal disease was performed using next Illumina® NextSeq 2000™ with a p1 (cat 20075294) reagent kit (600 cycles). Unique amplicon sequences were inferred from raw reads using the Dada2 pipeline, enabling a detailed microbial analysis pertinent to each disease phase.
The predominant taxa identified at the initial stage of periodontal disease (PD1) were *Porphyromonas cangingivalis* constituting 13.99% from all bacteria, followed by *Porphyromonas gulae* with the prevalence of 12.42%. At the PD2 stage, *Porphyromonas gulae* remained the most prevalent (13.07%), whereas *Maroxella* spp. was also detected in high numbers (8.32%). Progressing to PD3, *Porphyromonas gulae* was observed in 7.79%, followed by *Peptostreptococcus canis* (6.01%) and *Odoribacter denticanis* (4.8%). In the most advanced stage, PD4, *Porphyromonas gulae* and *Porphyromonas canoris* were detected at 7.43% and 4.75%, respectively and were the most prevalent species, followed by *Peptostreptococcus canis* which was also prevalent in high amounts (4.46%).
Our investigations demonstrated hight species variety of bacteria detected in dental pockets of dogs. *Porphyromonas gulae* were highly prevalent in all dogs irrespective of the stage of the periodontitis, but statistically higher numbers were detected in early stages of periodontal disease. Contrary, *Peptostreptococcus canis* was more obvious in the late stage of the disease. The data indicates that *P. canis* can be associated with periodontal disease more significantly than other microbiota. At the same time we noticed, that as the severity of periodontal conditions increases, the alpha diversity of bacteria also notable increases. This indicates that there are more bacterial taxa associated with higher stage of periodontal disease, therefore, there is a need to perform more deep analysis on all microbial taxa among the investigated groups.

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EVALUATION OF THE APPLICATION OF ULTRASOUND IN SMALL ANIMAL CLINICAL OPHTHALMOLOGY

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Ultrasonography is a useful diagnostic tool in veterinary ophtalmology because of its availability, non-invasiveness and safety. This diagnostic method is most useful for studying structures and pathological changes in retrobulbar space and within the globe. The aim of this study is to evaluate the application possibilities of ultrasound examination in clinical ophthalmology in order to improve the diagnosis of diseases and the evaluation of changes in the structure of the eye. All patients who have come to the clinic with ophthalmological complaints undergo an ophthalmological examination. However, special ophthalmological examination methods are not enough to establish diagnosis in all cases. If eye is opaque, or there is a suspicion of orbital pathology or trauma, ocular ultrasound examination can help to narrow down the list of differential diagnoses and avoid more expensive imaging. Also, ocular ultrasound examination is a sufficiently sensitive visual diagnostic method that can help to accurately assess the probability of saving the eye, surrounding tissues and, in some cases, vision and choose the most appropriate treatment method.[1]

Even for animals whose structures of the eye can be examined by ophthalmological means, ultrasound examination can be useful in identifying tumors within the eye or retrobulbary, measurements can be made using ultrasound, and comparisons of structures with the healthy eye can be made. Structures, such as the ciliary body, that are not visible during a routine ophthalmic examination can be evaluated with ultrasound. According to the results of a previous study, comparing ultrasound diagnoses with histopathological diagnoses, ultrasound diagnoses matched histopathological diagnoses in about 85% of cases.[2]

This study included 34 dogs of various breeds, ages, weights, genders, and 12 cats of various breeds, ages, weights and genders, which underwent an ophthalmological examination using special ophthalmological examination methods and an ocular ultrasound examination on both eyes. Structural changes in the eye were identified, documented and saved in the ultrasound machine. During medicament treatment plan, ocular ultrasonography and other ophthalmological examination methods were repeated to evaluate the response to treatment. After enucleation, differential diagnoses that were made after ultrasound examination were confirmed or denied by histopathological analysis of the globe.

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DETERMINATION OF MICROBIOLOGICAL CONTAMINATION IN COLOSTRUM AND ITS EFFECT ON CALF HEALTH

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Colostrum contains all the necessary nutrients and biologically active substances necessary for the development of the calf in its first weeks of life. Without the transfer of passive immunity, calves are more likely to develop diarrhea, respiratory disease, or die. Failure to ensure the transfer of passive immunity can occur if the immunoglobulins (Ig), present in the colostrum, do not have a chance to be absorbed from the digestive tract due to extensive bacterial colonization. Bacterial contamination levels of colostrum not globally validated, but in some countries, the highest bacterial count level accepted as 5.0 $\log_{10}$ CFU/ml for total bacterial count and 4.0-log10 CFU/ml - for coliform count. [1, 2]

The aim of the study is to find out the causes of colostrum contamination and its effects on the calves' health, and to understand if the methods used to determine the bacteriological contamination of colostrum are applicable in veterinary practice. The tasks of the research are the following: 1) to detect the bacteriological contamination of colostrum from its milking to the last feeding; 2) to discover the correlation for bacteriological results of fresh and frozen colostrum samples; 3) to find out a relationship with contamination of the colostrum and the morbidity of calves at the age 0- 30 days; 4) to probate the applicability of methods used in the study in veterinary practice.

The study conducted from August to October 2023 in two herds of dairy cows in the Vidzeme (V) and Zemgale (Z) regions with different incidence of diarrhea in calves.

3 colostrum samples were taken from 5 cows in each herd: 1 - from a prepared udder before milking; 2 - from the milking machine cistern after milking; 3 - after the milk was thawed before feeding it to a calf. All samples have been analyzed with the horizontal method of counting microorganisms (LVS EN ISO 4833-1:2014/A1:2022) at a laboratory of the Faculty of Food Technology, Latvia University of Life Sciences and Technologies, Jelgava.

In herd Z, the mean total bacterial count (MTBC) of samples (from milking to the last feeding) ranged from 4.84 to 5.89 $\log_{10}$ CFU/ml, but the mean coliform counts (MCC) ranged from 3.48 to 5.01 $\log_{10}$ CFU/ml for both frozen and fresh samples. In herd V, for the frozen samples MTBC was 4.65 – 5.38 $\log_{10}$ CFU/ml and MCC was 3.48 – 3.58 $\log_{10}$ CFU/ml. Conclusions: 1. Samples taken in herd Z were doubled both fresh and frozen, but in herd V – only frozen samples. The count was greater in all the samples collected from the milking cistern and for the frozen samples before analyzing from herd Z. 2. The highest correlation was r=0.66 between frozen and fresh MTBC samples that were taken from the udder, but the lowest correlation was r=0 between frozen and fresh MCC samples that were taken from the udder, but the p-value for all the sample groups was insignificant ($p>0.05$). 3. Colostrum bacterial contamination in herd Z was greater comparing to herd V and the morbidity was proportional. 4. The method used to analyze colostrum contamination is time consuming and needs different laboratory equipment.

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ENGINEERING

REDUCING ELECTRICITY COSTS IN SINGLE-FAMILY HOMES THROUGH MARKET PRICE FLUCTUATIONS

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This paper delves into the potential for single-family homes to reduce electricity expenses by capitalizing on market price fluctuations, a critical consideration for promoting energy efficiency and sustainability within the evolving energy market. With 83.4% of home energy use attributed to heating and hot water [1], which amounts to 14.6% of a typical family's income, the urgency for cost-effective energy solutions is clear [2].

Employing a methodology that includes the analysis of electricity price variations from the Nord Pool market throughout 2023, this research provides a comprehensive understanding of price dynamics. The data, revealing fluctuations from 40.62 EUR to 161.16 EUR per MWh with an average of 93.89 EUR, coupled with distinct usage peaks in the early morning and evening, lays the groundwork for identifying strategic electricity consumption adjustments [3]. Notably, the investigation pinpoints two periods of price dips—between 3-4 am and 2-3 pm—that offer opportunities for cost savings, especially when paired with energy storage systems [4]. This insight is pivotal for homeowners considering the integration of battery storage to economize by charging during low-price windows for later use. Given the average daily electricity consumption of 5.59 kWh among single-family residences, a fully charged storage system could provide electricity for 21 to 32 hours, showcasing a substantial reduction in reliance on grid electricity during peak pricing [5].

The study also underscores the importance of discerning the varied pricing strategies of local electricity providers, including those offering renewable energy options, to further optimize household energy expenditures.

In sum, this paper substantiates the significant impact that strategic engagement with electricity market fluctuations can have on reducing household electricity costs. By adopting informed consumption and storage practices, single-family homes not only stand to decrease their energy expenses but also contribute to the stabilization of community electricity prices by easing demand on the grid during peak times.

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OPTIMIZING CAM PROFILES TO MINIMIZE FOLLOWER ACCELERATION IN BOOK STITCHING MACHINE OPENERS

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This paper investigates the opener drive mechanism of a book stitching machine commonly used in the printing industry. The mechanism binds separate book signatures together and utilizes a combination of cam and gear mechanisms to provide axial and rotary movement for vacuum openers, however, the current design is prone to frequent breakdowns.

This research focuses on optimizing the cam and follower profiles to identify the factors contributing to and preventing accelerated wear. Prior studies have established the importance of minimizing acceleration in cam-follower mechanisms for design optimization [2].

To analyze the drive mechanism, the machine parts were meticulously measured and recreated in SolidWorks design. SolidWorks Motion software was then employed to develop a comprehensive motion simulation, providing valuable data on displacement, speed, and acceleration of the follower. A significant contributor to load and wear inside such mechanism is the spring that keeps the roller and follower in contact [3]. For this reason, the stiffness of the spring is also measured.

Alternative cam profiles were designed within SolidWorks, considering the desired function and key factors such as the cam base radius, roller radius, eccentricity and desired acceleration curves [1]. These alternative profiles were then simulated in the motion software, and the resulting data was compared to the original mechanism.

The research demonstrates that optimizing the acceleration curve of a cam mechanism can significantly improve the service life of the device. By improving acceleration curves, jerk in the mechanism is reduced, which leads to less induced stresses in the system [4]. By minimizing acceleration and achieving smoother movement of machine parts, stress and wear on the system are reduced, leading to fewer breakdowns and improved device longevity.

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ENVIRONMENTAL IMPACT ANALYSIS OF INTERNAL COMBUSTION MOTOR CARS AND ELECTRIC CARS

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Internal combustion engines are one of today's most significant environmental threats. From fuel extraction and refining to consumption in vehicles and other machinery, internal combustion engines produce greenhouse gas (GHG) and particulate emissions that disrupt the natural balance and cause climate change. Over the past 200 years, measurements of atmospheric carbon dioxide have increased from 278 ppm to over 417 ppm, a 50% increase [2]. GHGs contribute to climate change and global warming by absorbing energy and trapping heat in the Earth's atmosphere. Internal combustion engines produce the three most common GHGs: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Hazardous gases are toxic gases that can cause severe physiological effects if inhaled. These are carbon monoxide (CO) and nitrogen oxides (NOx). Particulate matter (PM) refers to tiny airborne solid or liquid substances such as soot and dust. Internal combustion engines emit a significant amount of PM, which poses a serious threat to the environment and health [2].

Electric cars do not emit CO2 emissions from the exhaust gases, because no fuel is burned. In order to perform a complete analysis, it is necessary to calculate the gases emitted during the electricity production process, which are concentrated at the place of electricity production. The electric motor has a twice higher efficiency than internal combustion engines, which significantly improves the efficiency of use. In many countries, electricity is obtained from fossil resources, which reduces the efficiency of electric cars. In Iceland, electric car charging produces almost no emissions, as there are mainly renewable energy sources: wind, solar, geothermal and hydropower. According to the European Energy Agency, electric cars still have lower carbon emissions than internal combustion cars and emissions tend to be 17–30% lower than driving a petrol or diesel car [1].

The following hypothesis is set: by reducing the number of cars powered by internal combustion engines, the impact of cars on the environment will be significantly reduced.

The goal of this study is to compare the amount of exhaust gases of internal combustion engine cars and electric cars in the Baltic region. In order to achieve the goal of the study, data will be collected in the Baltic countries and experiments will be conducted with different engine cars.

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DEVELOPMENT OF LEAF COLLECTION EQUIPMENT FOR INSTALLATION ON A ROBOTIC PLATFORM

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City parks and green spaces have been facing a problem with collecting leaves because it is a time-consuming and labour-intensive task, reliant on manual effort. In today's era of technological advancements, the integration of leaf collection equipment onto a robotic platform would help with maintenance where it has been manual labour.
The aim is to develop a technical solution for a tree leaf collection machine suitable for installation on a robotic platform. With the use of sensors and GPS the robotic platform would be able to map working area and work autonomously.
For leaf collection it is planned to use a vacuum type collector. There are three types of vacuum leaf collectors: handheld leaf collectors, walk-behind leaf collectors, and tractor-mounted leaf collectors. The plan entails utilizing tractor-mounted leaf collectors for development purposes [1].
Handheld devices primarily focus on blowing leaves. Manual labour is necessary to operate the device and for some types it is necessary to carry a bag for leaves. Walk-behind collectors use a vacuum fan to collect leaves in the container or bag. The problem is that it still requires manual labour and is time consuming. Tractor-mounted leaf collectors are more suitable for implementation on a robotic platform because they use more powerful fans, are able to collect larger quantity of leaves and have the capacity to operate for an extended time period.
To achieve the best outcome for a leaf collector it is necessary to research the suction system parameters. Research methods include: Computational fluid dynamics (CFD) analysis – by the use of software (COSMOS motion) it is possible to analyse the airflow through the suction fan and design the air intake and outlet sections for optimal performance. Rotational speed of the suction fan – the speed affects the performance of the suction fan up to a limit, after which increasing speed will not significantly improve performance. There are also risks of the system shutting down if the speed reaches the speed of sound. The speed of sound is not desirable because it disrupts the lifting force and loses efficiency [2].
Research in this paper show various ways of testing and designing the suction system. It is used to analyse methods and tools used for achieving the desired outcome. Since the researched system uses Power take-off (PTO) of a tractor to start the device, it has problems with regulating speed of the fan, therefore it has potential for improvements.
Overall, the research demonstrates the potential for robotic platforms equipped with optimized suction systems to improve leaf collection in urban areas and green spaces. By automating this task, time and labour can be saved significantly, allowing for more efficient park maintenance.

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ANALYSIS AND DEVELOPMENT OF AN ELECTRIC E-BIKE FOR SRI LANKA CONDITIONS. EFFICIENT AND SUSTAINABLE MOBILITY SOLUTIONS

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With increasing air pollution, traffic congestion, and reliance on fossil fuels, Sri Lanka's transportation problems demand a paradigm change to sustainable mobility. The viability and socioeconomic effects of deploying e-bikes as an environmentally friendly substitute are the main topics of this study. The project intends to analyze how well e-bikes fit into local commuter patterns, examine potential socioeconomic impacts, and gauge how well they adapt to Sri Lanka's varied geographic and climatic conditions [1].

Furthermore, the study suggests modifying the design and improving technology to optimize e-bikes in the Sri Lankan environment. A thorough literature research, field surveys in rural and urban regions, technical examination of e-bike components, cooperation with local authorities, and an environmental effect assessment are all part of the technique. One important way to address the development difficulties facing human societies is through environmentally sustainable transportation (EST) of which electric vehicles (EVs) are becoming a more sustainable form of transportation. Over the course of their useful lives, EVs provide considerable environmental and economic benefits that outweigh those of typical internal combustion engine vehicles (ICE). Although the government of Sri Lanka has implemented laws and regulations to encourage greener vehicles, the market has not been greatly affected by EVs. A study with an emphasis on two-wheelers, three-wheelers, and electric light-duty vehicles was carried out to comprehend the national EV scenario. The findings point to EVs' great potential for environmentally friendly transportation. Important factors include creating a suitable supply chain infrastructure, encouraging long-term policy decisions, and inspiring potential customers. The analysis highlights how crucial EVs are to the current fleet of vehicles in promoting positive environmental change [2].

According to the premise, e-bike customization will greatly improve sustainable urban mobility in Sri Lanka while lowering environmental effect and raising overall transportation standards. By demonstrating the revolutionary potential of custom e-bikes in promoting a robust and ecologically conscious transportation system in Sri Lanka, the study seeks to substantiate these hopes.

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HISTORY AND CULTURE OF TRADITIONAL AWA PAPER MAKING IN TOKUSHIMA

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This presentation will demonstrate the development of *Awa washi*, a traditional Japanese paper produced in Tokushima, and its role in creating a unique culture within the region, especially when paired with indigo dyeing, another significant cultural heritage of Tokushima. Both *Awa washi* and indigo dye boast a history extending over 500 years, marking them as prominent cultural symbols of Tokushima.

In the actual presentation, I will first illustrate how *Awa washi* was developed in Tokushima. The art of paper making in Japan traces back to the Nara period (710-794). In Tokushima domain, it was initiated by Tokushima's first lord, Iemasu HACHISUKA, who encouraged the cultivation and production of paper mulberry [1]. Following the first lord's initiative, the paper making industry flourished, becoming a vital source of revenue for the Tokushima domain. However, with the introduction of Westernized paper-making techniques during the Meiji period (1868-1912), traditional handcrafted paper making gradually began to give way to machine-based production methods [2]. Despite suffering severe setbacks during WWII, the *Awa washi* industry has experienced a resurgence in recent times. It is now celebrated as a traditional craft of Tokushima, especially when paired with the region's indigo dye, showcasing a beautiful amalgamation of traditional art forms.

In my presentation, I will also highlight the process of *Awa washi* production as observed in the *Awagami Factory*, a renowned art studio located in Yamakawa town, situated in the western part of Tokushima. The factory is celebrated not only as a production site but also as an educational centre, where individuals are invited to learn the intricacies of traditional handcrafted papermaking techniques. *Awa washi*, like other types of Japanese paper, is crafted from the bark fibres of shrubs such as kozo (mulberry) and gampi. This process involves several meticulous steps, starting with steaming to soften the fibres, followed by the removal of the dark outer bark to purify the material, and culminating in the actual papermaking process [2]. These steps underscore the dedication to quality and tradition that defines *Awa washi* production. Moreover, the *Awagami Factory* extends a unique opportunity for hands-on engagement, allowing visitors, including international tourists, to immerse themselves in the traditional papermaking experience. This not only serves as an educational activity but also fosters a deeper appreciation for the cultural significance and artisanal skill involved in creating *Awa washi*. By participating in these workshops, individuals gain insight into the rich heritage of Japanese papermaking and contribute to the preservation of this traditional art form.

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BATTERY ENERGY STORAGE FOR PROVISION OF PRIMARY FREQUENCY REGULATION (FCR)

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Today, the production, distribution and transportation of energy is undergoing a period of rapid change. This is happening due to the geopolitical situation in Europe, due to which EU states put achieving complete (or at least the maximum possible) energy independence at the forefront of their energy policy.

Other no less important factors provoking the need for modernization, adaptation and automation of energy systems are the goals of energy independence, climate neutrality, and the use of renewable energy resources set in EU countries. Speaking about the Baltics, the situation is also complemented by the fact that energy systems of the Baltic countries are planning to start parallel operation with the electrical networks of continental Europe and desynchronize from the BRELL circle by 2025.

Several problems are expected to arise and are already occurring in the energy sector in EU countries, on the way to climate neutrality and in the tendency to increase the share of alternative energy use. One such problem is lack of frequency containment and restoration reserve capacities in the power supply network (FCR and FRR), which is already occurring in the energy systems of the Baltic States and is expected to become the issue of the day after disconnection from the BRELL circle, as well as after increasing the share of solar and wind power generation in the network. The activation time of the FCR service is within some milliseconds, so in order for any kind of synchronous generator to be able to provide it, it must be in a rotating state, which is not always possible. But high-power battery energy storage systems (or BESS) with a response time of 100-200ms can be a perfect solution [2].

One of the challenges for integrating BESS systems is choosing the optimal state of charge (or SOC) recovery method. Depending on the state-of-charge recovery method, the impact on the power grid, the profit and payback period of the system, as well as the control algorithm of the BESS system changes [1].

Usually BESS systems are installed close to power plants so that there is no need of building new long range HV transmission lines. In Latvia's case, Riga HPP is already taking part in providing FCR so it would be logical to install BESS system nearby. In that case, the battery system and HPP generators will work together and should have some kind of automated control algorithm that primarily follows network frequency and BESS unit SOC.

While Riga HPP aggregates participate in frequency regulation, a control unit is constantly changing the output power of the turbines, which greatly increases the wear of the units and requires more frequent repairs. This way installing BESS system will not only make power network more stable and improve the quality of electricity but will also be an economically justified investment making profit both from providing FCR and extending HPPs working hours.

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LAND MANAGMENT AND GEODESY

SOLAR PANEL PARK PLACEMENT IN AGRICULTURAL TERRITORY

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Solar and wind energy are the most cost-effective among various energy sources, and each power station contributes to lower electricity prices. Establishing such stations is a step toward enhancing Latvia's energy independence. However, when placing a solar panel park in an agricultural area, there are potential trade-offs. Placing a solar panel park in an agricultural territory can lead to reduced agricultural yields and increased land degradation. The objective of this research is to identify more efficient strategies for placing solar panels, thereby minimizing their impact on agricultural areas.

As part of the country's strategic goals, there is a focus on developing electricity production using renewable energy resources, including the building of high-capacity solar power stations. Currently for energy production an increasing number of solar panel parks are being built and utilized which are situated on lands that are designated as agricultural territories according to zoning plans. Agricultural territory serves as a functional zone, ensuring rational and diverse use of agricultural land for various farming activities and related services [3].

Repurposing agricultural land for alternative purposes can have significant repercussions for both the agricultural sector and environmental sustainability. Key challenges include rising land prices, a decline in the number of farmers and workers, reduced environmental and biological diversity, and an increase in food imports.

Solar panels are industrially manufactured, ready-to-use electrical devices installed and operated in accordance with the manufacturer's instructions. Whether placed on building rooftops or directly on the ground, solar panels are considered equipment. Engineering structures designed for energy production, with a heat capacity of less than 100 MW, as well as all solar power stations (classified as engineering construction), fall into group II engineering constructions. The installation of solar panels (as equipment) on land or buildings does not necessitate for construction design documentation or approval from building control authorities [2].

In Construction Law, solar panels are not classified as buildings; hence, the provisions of this law do not apply to such equipment. However, this does not imply that municipalities lack the authority to restrict the placement of specific facilities and equipment through territorial planning documents. In such cases, the evaluation process ensures compliance with the rules outlined in the municipal territory planning documents, rather than constituting unauthorized construction under the Construction Law [1].

The most optimal locations for solar panel parks would be areas that do not jeopardize agricultural activities, for example building rooftops, landfill sites, and industrially developed areas.

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THE IMPORTANCE OF MOTION PLANNING AND DATA QUALITY FOR UAVS

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To use an unmanned aerial vehicle for any purpose, one of key aspects is motion or path planning. It ensures safety of users and nearby people by minimizing the risk of collisions with environmental obstacles, improves efficiency, opens up an opportunity to achieve multiple goals using fewer flights. The efficiency of the planned route significantly impacts the quality of collected data from UAV's sensors, like resolution and detail, coverage of the required area and also it affects overall flight time.

Most professional drone manufacturers offer their own software for path planning, which includes the ability to set parameters such as custom polygonal areas including virtual fences in all directions, adjust flight speed and altitude, overlap ratio, battery consumption, including even airspace information. Advanced drones have built-in collision avoidance systems which makes the drone adjust the flight path to avoid damage [1, 2]. Specialized hardware and software developers such as Pix4D, Drone Deploy, Sentera FieldAgent and CoFly, in addition to path planning, also offers solutions in precision agriculture. That includes: aerial photographs, crop health indices and yield, plant health information, weed detection [3].

There are multiple reasons which can alter the precision and stability to UAV's planned flight path, such as strong wind gusts, change of altitude, variable environmental objects which further affects the quality of collected data. Imperfections may appear as blurred images, changes in scale and illumination, misaligned images. Using possibilities that can provide AI, there is a way to determine the quality and resolution of UAV's collected data in real time. If software detects imperfections, then the flight path needs to be corrected or a re-flight needs to be performed [4, 5].

Technology advancements can increase energy consumption, but efficient path planning can often mitigate this by reducing flight time. By combining the UAV's built-in technologies with additional software and knowledge of the drone's pilot, is possible to achieve more information with fewer flights. As a result, the obtained data can be used for purposes such as land development and precision agriculture.

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TRENDS IN THE DEVELOPMENT OF RIVER VALLEY CONSTRUCTION AND THEIR STUDY BY REMOTE SENSING METHODS

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Rivers and their valleys are an important resource of human living space, biologically diverse and scenic environment in Latvia [1] and elsewhere in the world. Planning for the construction and use of river valleys has historically received increased public attention.[2] With the development of technologies for obtaining geospatial data and processing these data, the importance of remote sensing data in the analysis and planning of the development of territories plays an important role. [2] [3]

The tasks to be performed within the framework of the study are the identification of the study area and the compilation of available remote sensing data. Analysis of the existing spatial plans of the territories to be studied and the protection zones depicted in these documents and the flooded territories indicated, their impact in the development of the construction of the territory. When comparing the obtained remote sensing data in chronological order, determine the changes in building indicators.

Remote sensing data: satellite images, aerial photographs and their products, e.g. orthophoto maps, have been available for more than forty years, which makes it possible to analyse the spatial development of territories over time. [4]

The development of the construction of river valleys is faced with the variability of water levels of rivers. Sensitive water levels are increasingly causing significant material damage in Europe's territory as the environment and climate change. [5]

The accumulated remote sensing data provides an opportunity to analyse the recorded information on the territorial development and emergency situations in these territories, eg. floods, soil erosion, changes in water horizons.

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EVALUATION OF LAND CADASTRAL ASSESSMENT CASES IN ACCORDANCE WITH THE REQUIREMENTS OF REGULATORY ACTS

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The research was aimed at more detailed study of the peculiarities of land cadastral surveying in Latvia in certain periods of time and highlighting the most important aspects related to land cadastral surveying in Latvian regulatory acts. In the course of the publication work, literature research was collected and conducted, what is land cadastral surveying in general and what regulatory acts regulate it. The tasks set for the fulfillment of the goal were review and analysis of available information sources, collection of available data and development of conclusions.
Land cadastral surveying is the acquisition of data on the boundaries of a land unit or a part of a land unit, the distribution of land use types, real estate encumbrances and their area. It includes surveying the boundaries of land units, restoring the boundary, eliminating boundary inconsistency, determining the boundary, as well as determining the types of land use and collecting data on the encumbered areas, and preparing the appropriate land boundaries, situation and encumbrance plan. Surveying and restoration of land unit boundaries are also carried out as separate activities. In case of necessity, the issues of inconsistency of land unit boundaries and the possibilities of their prevention are addressed. All the above-mentioned actions can be performed only by a person (surveyor) certified in land cadastral surveying.
The land boundary plan is one of the documents required for the initial confirmation of property rights in the land register. On the other hand, if the land unit is divided or the land units are combined, then the land boundary plan, situation plan and encumbrance plan are the basis for the registration of a new cadastral object in the real estate state cadastre information system.
Land cadastral surveying in Latvia is regulated by the following regulatory acts:
1. Regulations of the Cabinet of Ministers of August 21, 2007 No. 562 "Rules on the procedure for the classification of land use types and the criteria for their determination";
2. Regulations of the Cabinet of Ministers of July 7, 2008 No. 522 "Rules of operation of the Commission for Land Border Disputes";
3. Regulations of the Cabinet of Ministers of December 27, 2011 No. 1019 "Rules of land cadastral survey";
4. Regulations of the Cabinet of Ministers of January 17, 2012 No. 60 "Procedure in which land cadastral surveying is carried out using state budget funds".
Land cadastral surveying regulations in Latvia play a crucial role in ensuring the proper management and utilization of land resources. By maintaining an accurate and up-to-date cadastre, these regulations promote transparency, facilitate land transactions, and help prevent conflicts over land ownership and boundaries.

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THE ANALYSIS OF GEOSPATIAL INFORMATION FOR EVALUATION OF THE AMELIORATION CADASTRE INFORMATION SYSTEM

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Remote sensing entails gathering information regarding an object or occurrence without direct physical interaction, usually employing satellites, aircraft, drones, or ground-based sensors [2]. This technology enables swift and repetitive identification of object locations and attributes [4]. The incorporation of remote sensing technology into cadastre information systems has transformed land administration methods, providing effective and precise avenues for data acquisition, analysis, and assessment [1].

Data on drainage systems have been updated from previously constructed drainage system plans and performance surveys. The plans and surveys were depicted on large maps, which are very opaque and difficult to read. With the development of modern remote sensing technologies, the plans of the drainage systems were digitised and merged into a public national information system - the Amelioration Cadastre information system. This cadastre contains a variety of textual data, which includes relevant information on the qualitative and quantitative condition and status of land reclamation systems, as well as spatial data containing cadastral plans, executive surveys and maps in analogue and digital form [3].

Amelioration Cadastre data has been updated using the documentation of previously constructed drainage objects. With the development of technology, the archive data were linked to topographic coordinates, which resulted in a discrepancy between the position of the archive data and the actual situation on site. The aim of the study is to identify the most accurate remote sensing method to improve and update the Amelioration Cadastre information.

The study site is a drainage system with an area of 265ha. The drainage system consists of 33 subsurface drainage systems (128.71km) and surface drainage systems (40.56km). The study compared the location of the drainage wells according to the Amelioration Cadastre archive data and open licence data of remote sensing technologies - orthophoto and LiDAR scanning.

In conclusion, orthophoto is the most appropriate method for updating the Amelioration Cadastre data. The LiDAR data provided incomplete information on the drainage wells. The main problems were the period of acquisition of the laser scanning data, the influence of the vegetation zone on the identification of the drainage well (limited visibility).

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REMOTE SENSING DATA USAGE IN CIVIL DEFENCE PLANNING AND MILITARY OPERATIONS

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Civil defence is an industry that has always been relevant and important. In this field remote sensing is widely used and developing rapidly. The aim of the research is to summarize the possibilities of using remote sensing data and evaluating its further development potential.
The war started by Russia in Ukraine has shattered decades of peace in Europe. There is an available research that uses open-access spaceborne remote sensing data to sense and investigate infrastructure damage at frontline and in cities on regional and national scales. Optical satellite images capture extensive flooding along the Dnipro River after the Kahovka dam burst. Using visible, near-infrared and wave satellite data, human disruption was revealed as well as environmental damage and the destruction of entire cities during the conflict [1]. This knowledge is important not only to record the war crimes committed, but also to help predict and prevent the future course of the war.
In another research the impact of the Russian-Ukrainian war on soil and vegetation was assessed - bombing increased the amount of fine sediments and metals in the soil, large-scale vegetation increased in south-eastern Ukraine and decreased in the east. Remote sensing analysis revealed that between 2021 and 2022, vegetation greenness decreased on a large scale (Eastern and South-eastern Ukraine) in areas with more intense fighting (Luhansk and Donetsk) and increased in the southern area (Zaporozhye and Kherson), possibly due to agricultural abandonment [2]. This study shows how strongly war can affect an area in the long term, polluting it with various fine sediments and changing the vegetation, as well as making people abandon their home.
With remote sensing data, it is also possible to conduct real-time monitoring to strengthen the protection of sectors before a dangerous situation escalates, as it was done in a study where sensor technologies were used to capture the situation in the maritime sector of the Malacca Straits Regional Defence [3]. With the help of remote sensing, it is possible to reduce the risks of marine accidents, environmental damage and piracy.
The use of remote sensing data is diverse and can also be used for the protection and control ofthe eastern border of Latvia, as well as for the prediction of dam danger situations like it was inJēkabpils. The military field goes hand in hand with remote sensing, and by working together with them, it is possible to get safer conditions and predict approaching dangers.

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DIFFERENCES BETWEEN TRADITIONAL SURVEYING METHODS AND DRONE SURVEYING

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Nowadays drones, also known as unmanned aerial vehicles (UAV), are being more often utilised in surveying [1] Drones have transformed the field of surveying bringing a wide range of benefits but are they better than traditional surveying methods? This research aims to compare traditional and drone surveying methods in terms of equipment, accuracy and precision, cost, and time efficiency.

Traditional and drone surveying are two different methods that are implemented to collect accurate spatial information. Surveyors use both methods to collect accurate spatial information, measurements, and data to help engineers design safe and efficient structures.

Comparing two methods of surveying in terms of equipment, drone surveying uses lightweight unmanned aerial vehicles which are equipped with cameras, and technologies such as LiDAR and GPS.[2] High resolution photos and other data are taken when drones are flying over a location, then this data is processed for maps and 3D models' creation. While traditional surveying implements heavy instruments such a theodolite, levelling rods and total stations to make accurate measurements.

Another difference between two methods is that drone surveying is typically more accurate than traditional surveying methods, because drone can capture data from variety of distances and angles. Traditional surveying also offers high accuracy and precision for ground level measurements, but there can be many factors that can affect accuracy such as terrain obstacles or weather condition and human error.

The third difference is that drones are more time and cost efficient as they can cover large areas faster than traditional surveying methods which takes more time due to manual measurements. Drone surveying may require a larger initial investment, but ongoing costs are typically lower as it requires fewer surveyors and such expenses as transportation and accommodation for workers.

In conclusion, both traditional and drone surveying methods are used to collect accurate spatial information, but they have differences in terms of equipment, accuracy and precision, cost, and time efficiency. The choice between the two methods depends on requirements of the project it's budget and the survey area.

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COMPARISON OF REMOTE SENSING METHODS FOR THE RENOVATION OF HISTORIC BUILDINGS

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Historic buildings often hold local history and cultural heritage, so it is important to collect data in the most suitable remote sensing method. Renovating historical buildings holds the tangible connection to history and brings environmental, economic, social and cultural advantages for the place.

Remote sensing platforms refer to instrument's attachment style either to structure or vehicles. Ground based platforms are handheld devices, also on a tripod, tower or other type of support mounted devices. Airborne platforms are aircrafts, based on altitude restrictions, also remotely controlled aircrafts. Satellite is the most stable platform of all mentioned, it is spaceborne [1].

Ground based instruments are used to measure small spaces, aircrafts and satellites are more precise and gives more information about obtained data.

Advanced technologies like Building Information Modeling (BIM) and laser scanning for various applications such as archaeological documentation and managing historic buildings are crucial for restoration. It highlights the effectiveness of BIM as a decision support system for cultural heritage management, particularly in tracking changes within historical buildings and aiding in their preservation. Laser scanning facilitates quick and accurate mapping of structures, allowing for the detection of structural flaws and serviceability assessment. Additionally, it mentions the challenges and benefits of applying BIM to existing constructions, especially heritage buildings, highlighting the importance of digital representations in understanding and preserving architectural heritage [2]. It is highlighted, that BIM and laser scanning takes a big role in restoration and preservation of cultural heritage. Applying BIM to existing heritage buildings could be challenging, but beneficial.

Integrating 3D survey techniques and BIM for Cultural Heritage management, is used for creating pint cloud models. It highlights the importance of the as-built BIM approach for documenting historic structures. Focusing on 3D survey data, it shows how point clouds help interpret complex geometries and streamline modeling. The study also explores using virtual and augmented reality for heritage documentation improvement [3].

Creating point clouds for cultural heritage using 3D survey techniques and BIM, can be supportive with complex geometries and streamline modeling, also for documentation improvement.

Aircrafts and satellites provide more precise and comprehensive data than ground based instruments. BIM and laser scanning play crucial roles in cultural heritage preservation, even there might be some challenges with existing sites. Also, BIM and 3D survey methods incorporation creates point clouds that simplifies modeling and helps with documentation.

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ENVIRNOMENT AND WATER MANAGMENT

THE EFFECT OF GREEN ROOFS ON WASTEWATER IN THE CITY

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The world's urban population is increasing, and it is expected to reach 67% by 2050. Despite socioeconomic benefits, urbanization leads to numerous environmental problems, such as urban floods and higher inner-city temperatures compared to the surrounding rural areas. Climate change further aggravates these problems by increasing the number and intensity of weather extremes [1].

Green roofs can help us achieve better purity of runoff water. Studies show that conventional roof drainage does not comply with standards for drinking water and that pollution associated with particles in runoff contributes to its toxicity and sedimentation. Metal roofs are a source of cadmium and zinc, and the asphalt used in roofing felt is a source of lead in the water flowing from the roofs. In contrast, green roofs offer a solution that can have a positive impact on improving water quality, aiding filtration through the vegetated layer as well as the substrate layer [1].

Green roofs could effectively neutralise acid rain to pH values between 8.25 and 8.63, which achieve the standard V (pH 6–9) of the Environmental Quality Standards for Surface Water. This neutralisation is an important environmental benefit that contributes to lowering the degree of water acidification [2].

According to Kohler & Schmidt research (1990), 95% of lead, copper and cadmium sulphides, and 19% of zinc coming from the rainwater remain in the substrate, helping to improve the local water quality [3].

The disadvantages of roof greening can be distinguished as follows: additional loads on the supporting structures of the building, engineering and technical complexity of the design, the high cost of arranging a green roof, the need for regular maintenance – both during flowering and in winter [4].

Green roofs are an effective means of improving the quality of wastewater in urban areas due to the retention of heavy metals in the substrate, filtration through the vegetation layer, and the reduction of flood risk. These systems not only contribute to reducing pollution and neutralizing the acidity of rainwater, but also contribute to the creation of sustainable urban ecosystems by reducing thermal effects and supporting biodiversity.

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EVALUATION OF THE ENERGY POTENTIAL AND HYDROLOGICAL REGIME OF THE SMALL HYDROELECTRIC POWER PLANT

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There are several types of HPP installations in the engineering solution to a hydroelectric power station (HPP). The adopted legislation, the hydromorphological and hydrological conditions of a river, a potentially obtainable amount of energy as well as the impact on environmental conditions often lead to the conflict of interests, corruption, and/or non-realization of the project (Kurtagi et al. ., 2022), and/or ignorance of environmental issues. Currently sustainable solutions are needed when building new HPPs or planning the reconstruction of existing one in the long-term to balance environmental protection requirements with economic benefits, because hydropower is green energy, on the one hand, and ecological impact, on the other hand. To justify the choice of an optimal HPP solution, it is necessary to enrich the knowledge about the impact of different solutions on energy potential and environmental quality (Lecler, 2018). The impact of different small hydroelectric power plant solutions on the dynamics of the amount of energy produced and the hydrological regime of the river is evaluated in the Master's thesis. The types of hydroelectric power plants installed in the world and Latvia have been evaluated and compared. The effects of barrage (dam) and diversion type HPP are compared and evaluated. To characterize the hydrological regime, fixed measurements of the amount of electricity produced in a small river without a hydrometric station (HMP) were used with another river data with hydrometric observations of a nearby. Categorized compartments selected for comparison of similar hydromorphological and close equal morphometric basin parameters with HMP data to create a hydrological data curve for the research. The study river data (Dīvaja) was compared to the few nearest rivers (Ogre, Perse, Viesīte), where is HMP data of State Limited Liability Company “Latvian Environment, Geology and Meteorology Centre”. Time schedules, runoff hydrographs, runoff, and generated electricity duration curves have been constructed for characterizing, evaluating and forecasting the hydrological regime and produced electricity. The volume and dynamics of the produced energy are compared depending on the technical solution of the HPP type - barrage or diversion. The operating efficiency of the selected HPP solutions were analyzed depending on the flow, because it is the changes in the hydrological regime that deny the acquisition of the river and renewable energy resources (Bhattarai, 2022).

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MODELLING OF EMERGENCY SITUATIONS IN WASTEWATER TREATMENT PLANTS

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The modeling of emergency situations in wastewater treatment plants is a crucial research direction focusing on the impact of unforeseen events on wastewater treatment systems. Considering the increasing importance of environmental protection and resource management, as well as the rapid development of the geoinformatics industry, there is a desire to understand how spatial data analysis can predict and assess the consequences of unforeseen accidents on the surrounding environment and its quality [1].

The available literature review reveals several sources where potential geographic locations for the construction of new treatment plants are examined and evaluated, taking into account land use types, terrain, underground water systems, and other geographical features. All of these data are compiled in GIS systems to conduct the analysis based on various determining criteria, creating various cartographic materials which rely on the latest satellite imagery and aerial photographs, as well as historically developed cartographic materials [1]. Such data collection can serve as a solid foundation for modeling emergency situations in wastewater treatment plants and understanding potential risks to the surrounding environment.

Other sources describe how essential some risk assessments can be. Risk assessments in wastewater treatment plants are necessary for protecting public health and the environment, ensuring regulatory compliance and maintaining operational continuity. By identifying potential failures and their impacts, these assessments help prevent the release of harmful contaminants, reduce downtime and manage costs effectively [2].

In addition, it would be necessary to collect data on the capacity of the treatment plant equipment, daily inflow and outflow quantities, location, and total volume of treatment basins, as well as to examine which environmentally harmful elements are filtered out from the wastewater [3].

To sum up, assessing various aspects of the risk with GIS technologies associated with waste water treatment plants helps to choose the best option from different aspects.

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THE POTENTIAL OF SAND-POLONITE FILTERS FOR REDUCING TOTAL PHOSPHORUS CONCENTRATION IN WASTEWATER

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Two of the main sources of biogenic elements are municipal wastewater and runoff from agricultural areas. Sufficiently cleaning wastewater can prevent the concentration of pollutants in the nature [3].

Municipal wastewater treatment plants for individual residential buildings are primarily based on biological processes with aerobic bacteria. They serve well in small-scale treatment plants to reduce concentrations of water quality generators BSP_5, COD and suspended substances and, where appropriate, nitrogen compounds. Specific solutions are needed to remove phosphorus compounds from the wastewater generated in a single-family residential building and individual treatment plants.

To reduce the concentration of phosphorus in individual treatment plants, one of the solutions could be to improve the sorption capacity, which could be provided by a sand-polonite mixture. The pH level of the polonite filter material is 9 - 12.5, and in the water phase, it is saturated with calcium ions, which promotes phosphorus separation. If the pH level in wastewater is high, then the efficiency of phosphorus separation will be higher [1,2].

The aim of this research is to develop an effective sand-polonite filter mixture for individual treatment plants to reduce the total phosphorus concentration in wastewater. The hypothesis is that the appropriate use of sand-polonite filtre proportions in the individual treatment plants will reduce the total phosphorus concentration in wastewater.

In the study, 9 different sand-polonite mixtures were developed with various material proportions. A phosphorus containing solution (C_{Ptot} ~ 15 mg/l) was prepared to determine the effectiveness of reducing the total phosphorus of the sand-polonite mixture by filtering water through the mixture. Using a spectrophotometer, total phosphorus concentrations were determined in the water before and after loading into the model.

The sand-polonite filter mixture showed good results and efficiency for reducing total phosphorus, reducing total phosphorus to over 90% at the outlet.

In mixtures with low (10-30%) Polonite content, the influenting factor on P_{tot} reduction efficiency was the retention time, as the longer the phosphorus containing solution remains in the filter, the greater the reduction in P_{tot} concentration was discovered in this research. In mixtures with moderate (40-60%) Polonite content, the influenting factor on P_{tot} reduction efficiency was the amount of Polonite in the mixture. In mixtures with high Polonite content, the phosphorus reduction efficiency was P_{tot} is >99%. The sand-polonite mixture showed a good potential in overall removal of phosphorous compounds in a laboratory scale research. The research should be up-scaled to field level to gain applicable results.

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EVALUATION OF SEDIMENTATION BASIN EFFICIENCY IN FOREST LANDS

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This research on sedimentation ponds was based on the accurate information on the surface area, length, depth of the sedimentation ponds and the area of the catchment basin. The catchment area is an important concept in hydrology and natural resource management as it helps to understand the circulation and distribution of water in a specific geographic region. It is also related to hydrological modelling to predict water flows, flood risks and other hydrological processes. The catchment area is also important in the context of environmental management as the catchment area can affect water quality and ecosystem health, as well as human habitation and agricultural development in a given region.
To perform calculations, the MMS maps were used available in LVMGEO (Geospatial Information Technologies of Latvian State Forests) database with isolines in specific object areas. The object areas of the specific forest drainage systems were marked manually guided by height isolines, then the area of the system in hectares was calculated and converted into square kilometres.
The technical data were collected in the table and the difference between the information available in designing projects and the personally researched information was calculated. Correct calculations will ensure more accurate parameters of sedimentation basins for future research activities to be focused on the efficiency of the elements of the drainage systems, which are better for the environment [1].
A sedimentation pond plays an important mechanical part of water treatment process for agricultural runoff and stormwater. In Latvia, the industry standards describe the parameters for the construction of a rectangular pool, but pools of other shapes should also be considered therefore their efficiency should be evaluated [2].
To sum up, the results showed that the calculations in the project were accurate, and the areas of the catchment basin were in accordance with those specified in the projects.

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MICROPLASTICS IN CENTRALISED DRINKING WATER SUPPLY SYSTEM IN JELGAVA CITY

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Plastic production in Europe reached 400.3 Mt in 2022 which only slightly differs from previous years [1]. Microplastics (MPs) are small plastic particles smaller than 5 mm [2]. They refer to comprehensive and globally distributed pollution in the environment: oceans, fresh water, sediments, soil and the atmosphere [3]. 1/3 of plastic waste goes to soil or fresh water, where most plastic breaks down into forming microplastics that end up in wider environment [4]. To understand the movement of MPs in the groundwater, it is necessary to understand the movement of MPs from the outset in the soil, and the potential for pollution to enter the groundwater since the same types of MPs may be transferred from soil to groundwater [5]. Drinking water sources in Latvia come from surface and underground freshwater [6] thus the danger of increasing potential MPs contamination in the water supply system is possible.
The research was conducted in Jelgava city, where water samples were taken in 10 sampling sites. Three water samples and one blank sample were taken in each site. Each water sample was collected by draining 100 l of water from the centralised water supply system through stainless steel sieve with pore size of 50 μm. Afterwards samples were transferred on fiberglass filter patch via vacuum system machine and examined under the microscope. Each fibre was tested by a hot metal needle to see the reaction and to find out if it is synthetic or organic material. The colour, length and plastics were recorded for each synthetic fibre.
The research results showed that microplastic was discovered in each water sampling site. The influence from proportion of plastic pipelines from the drinking water treatment plant to each water sample site was determined by the correlation analysis. In most cases, microplastic fibres were black, suggesting the contamination had come from the water distribution system.

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CIVIL ENGINEERING

BENEFITS AND EFFICIENCY OF AERODINAMIC ARCHITECTURE IN TODAYS CLIMATE

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Aerodynamics are becoming more important nowadays when considering recent climate changes, which result in stronger winds and more frequent hurricanes in the Baltic region. This abstract aims to explore the significance of aerodynamic architecture in civil engineering, emphasizing its crucial role in enhancing building performance and sustainability.

Our first source which is from "Journal of Physics" describes buildings that are round in shape and buildings in the form of an expanded book that are of exceptional interest from an aerodynamic point of view. What is also important to mention is that cylindrical buildings are better streamlined by air flows. Their air resistance is therefore less [1].

The primary factors influencing the form and alignment of buildings are typically architectural design, functional needs, and site constraints, rather than aerodynamic considerations. As a result, these constructions often experience elevated wind-structure interaction loads. Implementing aerodynamic modifications to the structure's shape and employing optimization techniques can substantially mitigate these wind-induced loads [2].

In the third source it is mentioned that the explanation lies in the subsonic flow dynamics: as wind approaches the building, positive pressure towards the ground and large negative pressure over the top cause the wind to divert before reaching the top of the face. This creates another stagnation point on the face, around 70% of the building's height, where the airflow divides between flowing up and over or down and around the building. This downward flow is predominantly near the center of the building [3].

In conclusion, the rising significance of aerodynamics, driven by climate changes and increased wind intensity, underscores the need for exploring aerodynamic architecture in civil engineering. The review of sources highlights the aerodynamic advantages of round and cylindrical building shapes, as discussed in the "Journal of Physics." Additionally, the research emphasizes that despite predominant influences such as architectural design and functional needs, aerodynamic modifications and optimization techniques can effectively reduce wind-induced loads on structures. Insights from the third source shed light on subsonic flow dynamics, explaining how positive and negative pressures affect wind diversion around buildings. This comprehensive understanding emphasizes the potential for enhancing building performance and sustainability through informed aerodynamic considerations in civil engineering practices.

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PORTLAND CEMENT WAYS OF PRODUCTION REDUCING CO2 EMISSIONS

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A huge amount of CO2 is released during cement production. The production of 1 ton of cement usually releases about 1 ton of carbon dioxide into the environment. For this reason, there has been a public debate about ways to reduce CO2 emissions. The purpose of the research is to analyze various methods of cement production that would be sustainable and more environmentally friendly.

Due to the global demand for sustainability, more advanced technologies have been recommended for the development of cement and construction purposes. Each ton of ordinary portland cement (OPC) generates a proportional amount of CO2 produced, so the main focus is on replacing OPC with low-carbon substitutes [1].

A fuel like biomass can effectively reduce CO2 (about 20-25%) if we compare it to coal. However, there are some practical problems when changing fuels: their chemical properties and composition are different from traditional ones, so different compounds enter the cement, which also reduces its quality (for example, lower strength is achieved). The use of recycled concrete powder (RCP) as supplementary cementitious material (SCM) to clinker can be an alternative to reduce emissions associated with portland cement (PC) and construction and demolition waste (CDW) disposal [2].

The use of RCP in cement mortars showed that binder consumption can be reduced by 9% and carbon emissions by 8% after 91 days, indicating that it is a viable alternative for the production of environmentally friendly cement. Currently, cement manufacturers use various wastes from other production (slag, fly ash, etc.) and natural mineral materials (limestone, pozzolans, etc.). The amount of bottom ash generated during the incineration of municipal waste increases significantly. Therefore, their recycling is necessary to limit their disposal in landfills, which cause environmental problems. The analysis will process municipal solid waste incineration bottom ash; as a secondary raw material for the production of portland cement clinker. Second example: successfully archived up to 30% of pulp and paper industry waste lime sludge (SL). It has a good potential to replace limestone in the raw mix for the production of cement clinker in the cement industry. Clinker made up to 30% provided very acceptable cement quality with an acceptable range of desired OPC cement properties [3].

In conclusion, we can say that the world is looking for different ways, so the world's largest cement production company has set a goal - from 2030. using ecological building materials to achieve CO2 neutral cement production. Also by 2050 it is planned to achieve complete carbon dioxide neutrality by replacing fossil fuels with solar energy [4].

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IMPLEMENTATION OF PRINCIPLES OF CIRCULAR CONSTRUCTION IN LATVIA

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Nowadays, increasing attention is being paid to improving the quality of life and health of the population. One of the factors affecting people's health is waste, as construction and building material production increase each year. Approximately one-third of the emissions generated in the construction industry arise directly from material extraction, manufacturing, construction processes, renovation, and demolition processes.

The topic of circular construction is highly relevant in Europe and worldwide. Circular construction is a strategy based on specific principles [1]: first and foremost, it is necessary to preserve and maintain buildings for as long as possible. If a building can no longer fulfill its function, ways to adapt it should be sought. Only when adaptation is no longer feasible should the idea of demolition be considered, with the salvaged elements or materials being reused. If reuse is not possible, materials should be recycled to create new, high-quality materials. Similarly, with the construction of new buildings, the first step is to look for existing buildings that can be adapted to meet the needs. The main goal is to avoid building materials or building elements becoming waste.

Currently, there is active implementation of the principles of circular construction into legislation and discussions among industry specialists. However, the general public lacks sufficient knowledge, leading to a lack of requirements for new construction projects. Integrating the principles of circular construction into everyday life is a way to live more environmentally and healthily, to change habits, as well as to develop building adaptation to sustainable construction principles [2, 3].

The aim of the research is to determine the advantages and disadvantages of circular construction, as well as to understand the attitudes of those involved in the construction process. The hypothesis posits that renovating buildings or their parts/elements is advantageous from the perspectives of sustainability and the circular economy.

Within the framework of the research, surveys were conducted among specialists in the construction industry, civil engineers, and architects, and the results were analyzed. Statistical data analysis was also performed. The study included inspection and analysis of objects within the boundaries of Daugavpils district, as well as evaluation and analysis of available examples in the digital environment.

The conclusions are the following: 1. As circular construction principles are becoming increasingly popular, there is a growing public interest in sustainable and environmentally friendly construction. This increasing interest may lead to the development of new policies and legislation that support circular construction principles. 2. Circular construction principles help to extend the service life of existing buildings or, when constructing new buildings, to plan for longer service lives. 3. Currently in Latvia, there is a lack of precisely prepared information for aspiring industry specialists, existing specialists and the availability of standards at the legislative level.

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USE OF WASTE MATERIALS IN BRICKS

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Brick is an ancient construction material that even now has not lost any of its relevance due to its useful properties. Despite that, traditional brick manufacture leaves tremendous hazardous effect on our environment in forms of waste due to carbon fuel usage,provided the scales at which this material is being made nowadays.

For example, currently Bangladesh operates over 7000 active brick kilns that produced approximately 32.4 billion bricks in 2019 [1]. The majority of the brick manufacturing processes are operated by conventional, highly unproductive, coal-fired kilns (Lee et al., 2021), and the annual carbon dioxide (CO2) emission to the atmosphere was estimated to be roughly 16.1 metric tons [1]. This results in serious threat to soil and it also escalates respiratory health risks, as well as climate change.

In an attempt to combat this, civil engineers searched for more energy-efficient and less harmful alternatives to traditional production, which brought forward the use of waste. To achieve it, various researches claim that we should find a way to prevent the natural resource consumption as clay, shale and sand in the brick production, replace them with industrial waste materials [3]. The utilization of such materials minimizes the damage of wastes and their disposal, however, the recycling of these materials can be done provided that the physical properties and toxic levels in the newly manufactured bricks comply with the applicable regulations [2].

Today, the future of brick production still remains almost unchanged through the ages,however significant updates to the process are required. Other than using waste materials, theresearchers say that we should seek for alternatives other than fossil fuels and promote the usage of renewable energy for brick plants [3]. This will help minimize CO2 and other greenhouse gases (GHG) emission to the atmosphere.

Traditional brick manufacturing is both inefficient and outdated and it also poses a major threat to the environment, therefore it is in need of change. Producing bricks by more eco- friendly and sustainable approach would be an important step towards environmental protection.

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GREEN ARCHITECTURE SUSTAINABILITY AND EFFICIENCY IN TODAY'S AND FUTURE SOCIETIES

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Green architecture is a philosophy of architecture that advocates sustainable energy sources, the conservation of energy, the reuse and safety of building materials, and the siting of a building with consideration of its impact on the environment [4]. This research study aims to ascertain the impact of green architecture on the environment and its use for society. Analyze the sustainability of green architecture in today's society and how sustainable it will be in the future. From planning and building, up to the finished structure, the entire process is sustainable and nature-friendly. The main goal of green architecture is to create something that helps the occupants and the surrounding natural habitat thrive in harmony [1]. To bring it all together and make the construction work environmentally sustainable, the green architecture uses renewable materials such as wood, sunlight, and solar and wind energy, and to bring it all together, vegetation is incorporated into the building's composition.

We spend a lot of our time indoors: at school, at work, and home. Often, the buildings we visit run on fossil fuel energy or are poorly insulated. Many are ill-suited to withstand the effects of climate change such as floods and heatwaves. To make our buildings more climate-friendly, we need to build better new structures, but also renovate those already standing, as most of them will still be in place for decades to come [3]. The cause of climate change not only affects our lives daily but also affects our life quality. As buildings and construction contribute up to 39% of carbon emissions, currently, sustainable architecture has become an essential solution [1].

In the future, this style of architecture can be not only a way to reduce climate change but also to improve people's quality of life by switching to renewable energy sources. These would not only be environmentally friendly and socially and economically sustainable solutions for urban renovation and development. And assigned certain technologies would allow the use of renewable energy sources, for installation, which would not harm human health. It is estimated that by 2030, 35 million buildings could be renovated and up to 160,000 new green jobs could be created in the construction sector [2].

The main conclusion of the study is that green architecture is not only a building but it is also an important aspect of society, these types of buildings reduce CO2 emissions and the building most of the time makes its energy. In the future these types of buildings will be more practical for life quality, they will use more sustainable materials. The buildings of this type will harmonically be compared to the environment making it appealing to the human eye.

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USE OF BIM IN CONSTRUCTION

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As technology continuously evolves, it is crucial to leverage its potential in the construction industry, which promotes the growth of Latvia's economy. In the conditions of high competition at the international level, construction companies must continually develop to increase efficiency and competitiveness. Lately, there has been discussion about the implementation of BIM (Building Information Modelling) in Latvian construction companies. It is understood that almost any innovations or changes, including the implementation of BIM in companies, are energy-consuming as they require investments both in technology and in training. The main aims are: 1) Understand the fundamental principles of BIM (Building Information Modelling) technology and its impact on the construction project lifecycle, including planning, design, construction, and operation. 2) Identify and evaluate the BIM standards defined in the "BIM Handbook 2022", including the latest standards, protocols, and procedures necessary for effective BIM integration in construction projects.

In accordance with the BIM roadmap developed by the Ministry of Economics, BIM will become mandatory starting from 2025, but already now, BIM competence provides significant advantages in acquiring projects. The development of BIM in Latvia is primarily a process initiated and driven by the private sector and private initiatives [1,2].

In a UN study in June, it was forecasted that the world's population will reach 9.6 billion by 2050, and the number of planet's inhabitants aged at least 60 will rise from the current 841 million to two billion by 2050, and to nearly three billion by the turn of the century. One of the main issues is the insufficient number of housing units and the development of infrastructure capable of meeting the increasing needs of the population. This leads to pressure on the construction industry to build new residential buildings, schools, hospitals, and transportation infrastructure more quickly and efficiently [3].

Building Information Modelling (BIM) is an integrated set of building design, construction, and management processes, technologies, and regulations that allows all involved parties to collaboratively design, construct, and manage a building in a digital environment. The BIM process encompasses not only geometric information but also time dynamics (4D BIM), cost calculations (5D BIM), optimization of design, construction, and operation processes, as well as the management of an object's lifecycle [3].

To implement BIM in your company, it is crucial to consult with knowledgeable professionals who will help develop a rational implementation plan, technology adoption, and staff training. All involved parties – the client, designer, and builder, can see from the very beginning what the planned outcome will be. BIM allows for the correction of errors in the project before the start of construction works, which would undoubtedly lead to additional expenses and extend the construction process.

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SOCIAL SCIENCE

ASSESSMENT OF MUNICIPAL SUPPORT FOR FAMILIES WITH CHILDREN IN THE RURAL MUNICIPALITIES OF LATVIA

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Starting from 1991, the rural population of Latvia is characterized by stable negative demographic trends. In general, the future of rural areas is particularly threatened by problems such as low birth rate, population aging and out-migration. The in-migration of young families with children in the countryside can help stop population decline and contribute to the regeneration of society. Scientific literature also demonstrates that rural newcomers may contribute to the demographic imbalances and loss of the human capital and highlights rural newcomers as the agents of change [1].

Municipalities play an important role in providing support to families with children, as they can contribute to the growth of the population and sustainable development of society, especially in municipalities with negative demographic trends, promoting the attraction and integration of families in rural areas. In recent decades, population migration from big cities to the countryside has been increasing. The survey results of the Latvian Rural Forum showed that newcomers to the countryside are mainly families with children, as well as couples, aged 35-55 [2]. The aim of this study is to identify and evaluate the types of municipal support for families with children in the rural municipalities of Latvia. In order to achieve the goal, the method of literature analysis was used.

Analyzing the information collected by the Society Integration Fund on the opportunities, offers and support for families with children available in municipalities [3], various types of support offered by municipalities were identified, including financial support, discounts, services and infrastructure. The municipal support for families with children is multifaceted and applies to a wide target group (new families, large families, foster families, low-income and destitute families, as well as families with a child with disability), and also varies depending on the priorities of the municipalities and the interest in attracting new people to the territory.

Acknowledgement:
The research is part of National Research Program project VPP-LETONIKA-2021/4-0002 "Cutting-edge knowledge and solutions to study demographic and migration processes for the development of Latvian and European society (DemoMigPro).

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DECOMPOSING PRICE DEFLATORS OF LATVIAN FOODSTUFF

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Coming against the backdrop of multiple consecutive events, namely COVID-19 and the Ukrainian-Russian conflict, few other topics in agricultural economics have generated more discussion amongst the general Latvian public and caught considerable attention and awareness from the affectation of food, consumer goods and product price increments.

The COVID-19 shock altered supply chains worldwide for many commodities extending its effects to the value chains themselves, with the culmination of the agricultural food market sector being impacted, which was further exacerbated by the Russian invasion of Ukraine spiking global energy prices. However, despite not being unsubstantiated, latest data from the Consumer Price Index (CPI) [1] has shown that on the third quarter of 2023 prices stabilized and, in some sectors after the last quarter, actually declined.

In Latvia food expenditure accounts for the majority of household budget's disposable income [2], therefore ensuring that affordable quality food is permanently available to residents is of the essence. Also, it is important to be self-sufficient at the outset of a military outbreak. Inputs such as fuels, water and fertilizers have an impact on commodity prices such as grains, which in turn can affect retail consumer prices, authors such as Leibtag, a researcher from the United States department of Agriculture (USDA), et al [3] remind us. Will prices of inputs and commodities that have been going down in Latvia and continue to cause headline deflation?

The aim of this study is to asses if and how are food consumer prices in Latvia significantly dependent on input costs by researching products composed majorly of commodities whose price has changed after a deflationary period begun in September 2023. In this study the author ascertains if the null hypothesis (non-stationarity) has a connection to hypothesis, testing unit root and using t value approach, a formal Dickey-Fuller test.

- H0: $\beta 1 = 1$ where there is a stochastic trend in the time series vs.
- H1: $|\beta 1| < 1$ there is no nonstationarity in the time series

In order to achieve the set aim, the research methods of aggregate analysis of level datasets using a two-factor linear regression model and autocorrelation matrices to disseminate which products remain accessible and retain their price when others do not, with a significant difference level for the tests as 5% ($P < 0.05$).

The results of this study show that CPI index in Latvia has already peaked and purports to remain stable; there has been a downtrend among raw materials and key products with said deflation forecasted to continue.

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SUPPORT OPPORTUNITIES AND CHALLENGES FOR DIGITIZATION OF BUSINESS PROCESSES

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Digital transformation also includes digitization of financial management processes. The aim of the study is to evaluate the availability of funding for the digitization of business processes as an essential aspect of ensuring the process. In Latvia, the Digital Transformation Guidelines set an overarching goal to create such society, economy and public administration that purposefully exploit existing and create new opportunities for digital technologies, as well as the environment created by them, improving the quality of life for every individual and society as a whole, increasing the competitiveness of the state and national economy [2]. Digital transformation is successful if it involves facilitating control in the organizational management approach [1].

One of the limiting factors for transforming the working environment into a digital environment is a financial aspect. This is addressed in the European Union through the Recovery Fund Program. The Recovery Fund aims to support reforms and investments related to the transition to the green and digital economy and to mitigate the social and economic impact of the *COVID* crisis [3]. In Latvia, companies operating in eligible areas may receive support, if they comply with the conditions set and if they have requested support. The maximum amount of the aid available to Latvia in the form of grants is EUR 1.82 billion, of which the aid planned for digital transformation is 20% or EUR 365.2 million. Since 2023, the support program for entrepreneurs "Support for digitization of processes in commercial activities" has been implemented in Latvia with the total aid amount of EUR 37.5 million, ensuring digitalization of internal processes in commercial activities and increasing productivity. The aid is allocated in the form of a grant voucher: micro and small merchants have access to a small voucher up to EUR 5000, while other merchants, non-governmental organizations and the state capital companies have access to a large voucher up to EUR 100,000 [4].

According to the information compiled by the Investment and Development Agency of Latvia, by March 10th, 2024 the amount of funding granted is 8.16% or EUR 3,061,760, of which almost 70% are for enterprises in Riga planning region [4]. The period of implementation of the aid will last until March 31st, 2026.

In order to implement the digitization of financial management processes, an important aspect is the funding available to companies in the supported fields within the framework of the Recovery Fund programme.

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APPLICATION OF THE FRAMEWORK CONVENTION FOR THE PROTECTION OF ETHNO-LINGUISTIC MINORITIES: THE CASES OF LATVIA AND ITALY

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When borders shift, they often leave ethnolinguistic minorities behind, who, in the context of democracies where the majority dictates policies, risk marginalization. In the Nineties, European borders were redrawn, sometimes peacefully, but often amid violent conflicts. This era spurred a renewed focus from researchers Brubaker, 1994, Francescato, 1993, Kymlicka, 1995, [11, 13, 14] and the international community on the plight of national and ethno-linguistic minorities. Consequently, the Framework Convention for the Protection of National Minorities was established, with Italy and Latvia becoming signatories in 1998 and 2005, respectively. As per the Convention, member states must periodically submit reports detailing their efforts to uphold its principles (art. 25 of the Framework Convention) [12]. Currently, Latvia is in the final stages of completing its fourth monitoring cycle, while Italy is poised to embark on its sixth cycle by the end of March 2024.

Despite their shared commitment to minority protection, each nation grapples with unique challenges and discrepancies. To delve into these nuances, the authors conducted a thorough analysis of the reports submitted by both states, alongside the insights and evaluations provided by experts from the Council of Europe, the overseeing body responsible for ensuring adherence to the convention's tenets. The examination focused on several key aspects, including the minority groups encompassed within the convention's purview in each country and the range of policies implemented to address their needs, categorized according to Anderson's framework [10].

While both Italy and Latvia have made notable progress in advancing minority rights, persistent shortcomings, especially in the inclusion of the Roma population, continue to be a concern. A notable disparity lies in the approach to safeguarding minority rights: Italy adopts a territorialized approach, as most recognized minorities reside in specific border regions, whereas Latvia faces challenges due to the dispersed nature of its largest minority group. In Italy, the Third Opinion (2011) highlighted concerns over funding cuts, while subsequent Opinions (2016, 2022) raised criticisms regarding the management of the Roma population and the heightened risk posed by hate speeches in the media environment. Nonetheless, one could argue that since joining the convention, Italy has not experienced significant setbacks in its application. Conversely, there has been a noticeable shift in Latvia's attitude. The Committee praised Latvian efforts in safeguarding minority interests in its Second Opinion (2013). Unfortunately, subsequent Opinions (starting from the Third in 2018, and particularly the Fourth in 2023) recorded a marked decline in the implementation of the Convention, attributed to heightened geopolitical tensions.

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THE EVOLUTION OF MARKETING CONCEPTS IN RESPONSE TO CONSUMERS' SUSTAINABILITY COMMITMENTS

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Numerous sources highlight the close relationship between the evolution of a theoretical framework for marketing and economic theory. Marketing revolves around fulfilling customers' expressed needs in response to demand. Moreover, many fundamental marketing principles, concepts and models are closely linked to theories of business management. The marketing concept is defined as a company's guiding philosophy focused on meeting customer desires and requirements, thereby ensuring the success of the company [3]. It expresses the idea that the success of a company is closely linked to increasing efficiency relative to competitors by producing, delivering, communicating and creating more customer value for the target market [1].

Following evolution of marketing concepts, the author highlights the enduring influence of consumer behaviour, societal values, and decision-making processes on contemporary marketing concepts. Consumers now prioritize sustainability in their purchasing decision, demanding transparency and sustainable offerings from companies. Consequently, society's focus on ethical business practices integrates corporate social responsibility (CSR) into marketing strategies, demanding social and environmental care. Ethical advertising and green marketing concepts have emerged in response to societal demands for responsibility and sustainability.

There is still no universal approach to marketing ethics. However, it is an important factor in encouraging marketing decisions that are well as being beneficial to society [5]. As consumers become more environmentally conscious, companies use greenwashing techniques to exaggerate and misrepresent their environmental practices. To combat greenwashing, companies need to be transparent and accountable in their environmental claims [4]. Combating greenwashing is a major challenge for sustainable development as it involves unethical practices and tends to mislead consumers by providing false information about the product [2].

In summary, it can be said that ethical standards are an indispensable condition for the development of environmentally friendly behaviour, a sensible attitude towards profit-making activities, achieving the objectives of sustainable development while maintaining sustainable business.

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INSIGHT INTO PRESENCE OF TATTOO STIGMA IN PERCEPTION AND ATTITUDE

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Tattoos have a rich history and hold a significant sociological importance. Tattoos are not merely decorative but are deeply intertwined with personal and cultural identities, serving as symbols of self-expression and individuality [1]. In the EU, tattoos have become increasingly prevalent over the past decades reflecting shifting societal norms and attitudes towards body art. Despite their growing popularity, tattoos still carry a certain stigma in some circles, often associated with deviance or non-conformity [2].

Firstly, perceptions and attitudes are closely intertwined concepts that play a crucial role in the formation of stigma. The research by Crocker & Major highlights how negative stereotypes held by individuals can influence their behaviour towards stigmatised groups, leading to a self-fulfilling prophecy where stigmatised individuals internalise these negative perceptions and behave accordingly. This process demonstrates how societal attitudes and beliefs can shape individuals' self-concept and behaviour, contributing to the perpetuation of stigma associated with certain groups or behaviours [3].

So the research on people's perceptions and attitudes towards tattoos is crucial in understanding and addressing the perpetuation and formation of stigma associated with tattoos. Sociological constructionism provides a theoretical framework to explore how societal beliefs and norms shape the meanings attributed to tattoos and influence individuals' experiences within this cultural context. By examining the ways in which tattoos are perceived and interpreted by different social groups, researchers can uncover the underlying mechanisms that contribute to the stigmatisation of tattooed individuals.

Secondly, understanding the impact of tattoos on individuals goes beyond the physical aspect and delves into the social dimensions of identity construction. Tattoos can influence how individuals are perceived and categorised within society, affecting their interactions and sense of belonging [1]. Nolan argues how concealable stigmatised identities, such as tattoos, can lead to psychological distress and health issues due to anticipated stigma and cultural perceptions. This stigma can create barriers to full participation in society. By investigating the complex interplay between tattoos, identity, and social perceptions, researchers are able to shed light on the nuanced ways in which stigma is constructed in the contemporary society.

Finally, tattoos hold multifaceted meanings and play a significant role in shaping individual identities and social interactions. Researching people's perceptions and attitudes towards tattoos is essential for unravelling the complexities of stigma surrounding tattoo culture and for gaining insights into how these cultural practices impact individuals within society.

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DIFFERENCES BETWEEN MAJORITARIAN AND PROPORTIONAL ELECTORAL SYSTEMS IN THE CONTEXT OF LATVIA

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In recent years Latvia has seen a change in its political landscape due to the fact that one of its largest political parties has been drastically losing support. This is why a re-examination of the Latvian electoral system is of importance. The aim of the research is to review the available literature analysing the differences between majoritarian and proportional electoral systems and to evaluate how these differences could manfest themselves in the context of Latvia if it were to change electoral systems.

The author analysed three scientific articles. The first of them analysed how common gerrymandering is in each type of electoral system [1]. Redrawing of constituency borders is shown to be more common in majoritarian electoral systems especially in large countries. The Latvian seven party parliament, historical district boundaries and the use of the proportional system make gerrymandering less common, even still if policy makers decide to change it to a majoritarian system, the small size of the Latvian parliament, cultural unity across regions and public opinion on regional reforms are factors that would lead to less incentives to gerrymander.

The second article shows that preferential voting increases voter satisfaction with the democratic system [2]. The Latvian open list ballot structure reduces citizen satisfaction with the democratic system and concentrates power in the hands of the political elite, which already has a great deal of power because of the privatization of public property in the 1990's. The small size of the Latvian parliament, large district sizes and its short democratic experience lead to less satisfaction, while the proportionality of the system leads to more positive views.

Proportional systems tend to produce better voter turnout, but there is a theoretical argument to be made through which the tendency of majoritarian systems to increase accountability can increase voter turnout [3]. This can serve as a means to lower a political accountability problem which is prevalent in Latvia [4], and in turn increase voter turnout which at the moment stands dangerously close to the 50% mark.

In conclusion, when deciding on the change of the Latvian electoral system, some key considerations should be taken into account: the presence of many factors making gerrymandering less common in Latvia even in a majoritarian electoral system, the use of preferential voting to increase voter satisfaction and reduce the power of the political elite, the tendency of majoritarian systems to increase political accountability.

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STUDENTS IN THE CENTER OF CHEMISTRY CLASSES: INQUIRY-BASED LEARNING

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STEM subjects, particularly Chemistry, are less popular among secondary school students. This issue is not unique to Hungary; it also exists in other countries [1, 3]. Student-centered strategies incorporated into classroom instruction can be a possible solution for this problem. Our main area of interest was the prevalence of inquiry-based learning (IBL), which has the potential to improve other important skills in addition to attitudes [4].

The questionnaire survey, we conducted in the summer of 2023, involved 124 teacher trainees studying at the University of Debrecen. The data show how frequently teachers applied student-active teaching methods in Chemistry classes around 2020, as well as how these methods affected learners' attitudes toward Chemistry. It is quite informative to ask teacher trainees because this way we not only gain information about the past, but also have some conjectures about the future, as people tend to teach in the same way that they were taught [2].

As for the pilot questionnaire, it was compiled from previously tested questions (for instance, from the relevant questionnaire of the PRIMAS project), as well as from questions developed by us on aspects that have received limited attention so far. Our subscales include attitudes toward Chemistry (4-point Likert scales and semantic differential scales), experiments and other methods used in classes (4-point frequency scales), and the appearance and likeability of the constructivist approach of IBL in lessons (4-point frequency scales and 4-point Likert scales). Furthermore, the respondents were asked to rank the characteristics of an ideal Chemistry class in order of importance. We used SPSS 28 to analyze our data.

The results demonstrate that some of the components of IBL —such as open-ended questions— were present in classrooms even though the strategy itself was not used at the time. We identified a positive correlation between learners' attitudes and the appearance of particular methods including student-run experiments ($r=0.289$) and real-life examples ($r=0.378$). Another significant finding is that students prefer diverse lessons which correlates with the facilitator role of the teacher ($r=0.43$).

Despite the potential benefits of IBL, however, it is critical to apply student-centered strategies consistently since they have some less desirable aspects as well. In order to determine which factors are most common and how they either improve or worsen learners' attitudes toward chemistry, we are asking current secondary school students about the same factors in a follow-up study.

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POST-KEYNESIAN THEORIES OF REGIONAL GROWTH

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The Keynesian school, including its post-Keynesian approaches, has been one of the most influential in the world history of the 20th century. The research sets out the following tasks: to examine the course of development of post-Keynesian theories and to outline the main features of post-Keynesian theories. The theoretical sources on the research topic were books, publications in scientific journals, information available on the Internet.

At the beginning of the 20th century the economic research focused on developing new theoretical concepts for dynamic analysis of macroeconomics. The economist J.M.Keynes proposed a growth model according to which national income increases in response to increasing aggregate demand [1]. At present there is no unified growth model that is relevant for every research.

Post-Keynesian theories of regional development emphasize the role of demand-side factors such as consumption and investment in promoting economic growth. The role of income inequality, institutional factors such as labour market regulations and financial systems are examined. Post-Keynesians argue that markets are not always efficient, and that the government intervention may be necessary to eliminate market failures and promote growth [2].

Series of books “Advances in Spatial Science” contains scientific studies focusing on spatial phenomena, utilizing theoretical frameworks, analytical methods, and empirical procedures specifically designed for spatial analysis bringing together innovative spatial research utilizing concepts, perspectives, and methods relevant to science and policy making.

Post-Keynesian theories of regional growth continued to develop in the following years, emphasizing the role of institutions, path dependence and demand-driven growth. Post-Keynesian theories of regional development have been influenced by various economic theories, including Keynesian and neoclassical, but have also sought to address limitations of these theories, such as the exogenous nature of technological progress [3].

In general, post-Keynesian theories of regional development offer a different perspective on economic growth and the role of government intervention compared to neoclassical growth theories. While the neoclassical theory emphasizes supply-side factors and market efficiency, the post-Keynesian theory emphasizes demand-side factors, distributional problems, and the potential need for government intervention to promote growth and stability in a regional context.

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QUALITY OF LIFE OF FAMILY MEMBERS WHO CARE FOR ONCOLOGY PATIENTS

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The quality of life of family members who care for oncology patients is a topic of great importance and concern. The emotional, physical, and financial burdens placed on these caregivers can have a significant impact on their overall well-being. Understanding and addressing the challenges faced by these family members is crucial in providing them with the support and resources they need [3].

The aim of the study is to investigate the quality of life of family members caring for oncology patients and the factors influencing it in the context of the existing support system. The study used a quantitative and qualitative research approach. A population survey (108 respondents) and six semi-structured interviews were developed for the analysis of the results.

The study is based on Family Systems Theory, an approach to understanding human functioning that focuses on the interactions between people in the family and between the family and the context(s) in which the family is embedded [2].

Oncological diseases are the second most important cause of death in Latvia, the number of which increases every year (295.7 cases per 100 thousand inhabitants in 2012 to 307.8 in 2018). In 2022, 11 509 deaths were caused by malignant tumors [1].

Analysis of surveys and interviews about the quality of life of family members of oncology patients revealed several important findings. First, the emotional impact on family members was significant, and the burden often persisted even after the patient's death. Second, there was a lack of guidance and support, which left family members feeling confused and unsure of how to proceed with the situation. Financial stress was also a major concern, with high treatment costs and limited government-funded treatment services adding to the strain. In addition, bureaucratic problems and limited expertise in the range of support services further revealed gaps in the existing support system. These findings highlight the need for increased emotional support, guidance, more serious financial assistance, and streamlined processes to improve the quality of life for family members who care for cancer patients.

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THE QUALITY OF VOCATIONAL EDUCATION PEDAGOGUES' WORKING LIFE IN THE CONTEXT OF CHANGES IN LATVIAN EDUCATION SYSTEM

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In the context of rapid global changes, vocational education must be able to flexibly adapt to the needs of the labour market by offering learning opportunities of good quality to each individual. The main element are pedagogues, i.e., people who transfer their knowledge and skills to others in order to educate future professionals for the promotion of society's development. Therefore it is essential to pay attention to the need of improving the quality of work life (QWL). QWL takes into consideration an employee as a person, not just the work itself. It focuses on the methods with which an organization can ensure the well-being of employees [3]. The aim of the theoretical part of the research presented in the article is to determine the main directions of change affecting vocational education pedagogues' QWL, based on sociological theories, educational policy documents and previously conducted research.

In order to find out which directions could influence vocational education pedagogues, the author studied the following Latvian development planning documents: Latvia's growth model "People first", Sustainable Development Strategy, National development plan (NAP2027), Government declaration and Action plan, and Educational development guidelines. These documents emphasize the importance of education, including vocational, in the context of national development. It is necessary to invest significantly in human capital and in promoting the quality of life of the citizens, which also means obtaining and improving qualifications, which is largely provided by vocational education. NAP2027 emphasizes that it is important to attract and keep young and motivated pedagogues and to raise their salary, thereby rising the prestige of the profession [1]. In October of 2021, the educational company "Lielvārds" carried out the study "Voice of teachers", which revealed that, despite the above mentioned development plans, teachers in Latvia feel like hostages of the lack of time and quality of work, and also, in terms of pay, they historically feel undervalued [2]. Every third pedagogue feels demotivated and pessimistic about the future in this profession. One in ten pedagogues work 57 or more hours every week. The new curriculum approach is also an additional burden. Only one in four sees themselves working as pedagogues after 5 years [2], so it was no surprise when in April 2023 there was a strike to stand up for balancing workloads and increasing salaries. Negotiations are still going on. If we do not systematically work on the support and motivation system, we can expect soon a much greater shortage of pedagogues in the education system [2]. Ensuring and improving each pedagogues' including vocational, QWL, working towards an adequate workload as well as remuneration are very important to ensure the improvement of the education system, the achievement of the set directions of action and the economic development of Latvia.

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