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CONTENT

ARTS

BIOLOGICAL SCIENCES

ECONOMIC SCIENCES

JURISPRUDENCE

MATHEMATICAL SCIENCES

MEDICAL SCIENCES

PEDAGOGICAL SCIENCES

PHILOLOGICAL SCIENCES

PHYSICAL SCIENCES

PSYCHOLOGICAL SCIENCES

SOCIAL SCIENCIES

TECHNICAL SCIENCES

ARTS

AN OVERVIEW OF THE USE OF 3-D PRINTING IN THE FASHION INDUSTRY

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Abstract

The integration of 3D printing and design technologies into the fashion industry has created new opportunities for customization and flexibility in apparel production. These innovations enable faster creation of new clothing models and allow designers to experiment with unique designs, distinguishing themselves from conventional mass production. However, the widespread adoption of 3D-printed clothing faces limitations due to the rigidity of current materials, which impacts flexibility and comfort. Despite these challenges, designers like Iris van Herpen and Victoria Beckham have successfully incorporated 3D-printed elements into high-fashion collections, highlighting the technology's artistic potential. Current applications are primarily found in accessories and avant-garde designs, where rigidity poses fewer issues. The future of 3D printing in fashion lies in personalized, eco-friendly production with further advancements in material science and cost reductions.

Keywords: 3D printing, fashion industry, additive manufacturing, customization, design innovation, personalized production, accessories.

The development of science and innovative technologies is an important driver for transforming various industries, including the apparel industry. In recent decades, 3D printing and design have become an integral part of modern manufacturing processes, creating new opportunities for customization and flexibility in the production of clothing and accessories. These technologies are actively integrated not only into production processes but also into design development, significantly impacting the speed of releasing new models of clothing and accessories [1].

In the context of global economic and digital production, where the fashion industry faces the challenge of increasing production rates, additive manufacturing technologies open up broad prospects [2]. They allow for a significant acceleration in the creation of new models and experimentation with unique designs, drawing the attention of both manufacturers and designers who seek to stand out against standard offerings of mass production [3].

However, despite significant advancements in 3D technology, creating clothing using 3D printing is still relatively new and faces a number of limitations, including the rigidity of materials used [1]. The issue of flexibility and comfort in such clothing remains relevant, making the production of clothing based on 3D technologies not yet widespread.

Despite many advantages, the use of 3D printing in mass clothing production is still limited due to the complexity of creating flexible and comfortable fabrics. However, in designer clothing, 3D printing has found wide application, particularly in creating unique collections, show events, and exclusive items that demonstrate the potential of this technology [4].

Dutch designer Iris van Herpen is one of the most well-known figures actively using 3D printing in her collections. She began implementing this technology back in 2010 when she presented her first collection with 3D-printed elements. Her works are often described as art objects where fashion and technological boundaries blur.

An example of this is her "Crystallization" collection (2010), which featured elements printed on a 3D printer. Van Herpen used SLA (stereolithography) technology to create intricate, crystalline structures that were not just decorative but also functional, reflecting complex geometric shapes characteristic of natural minerals and crystals. In her approach, the designer combined traditional materials with additive printing technology, allowing for new forms and textures that could not be created by other methods.

One of her most famous projects was the "Synthetic Biological" collection presented at Paris Fashion Week in 2012. This collection used printed elements

that mimicked fabrics but were made in unique, mechanical forms, highlighting the fusion of technology and nature [5].

In 2016, British designer Victoria Beckham presented a clothing collection featuring elements created with 3D printing. She collaborated with Shapeways to add 3D-printed materials, such as plastic and metal, to her dresses. Beckham used 3D printers to create accessories and decorative elements on fabric surfaces, giving the collection an unusual and high-tech appearance.

3D printing is actively used to create accessories such as shoes, bags, jewelry, and headwear. For example, designer Zaha Hadid, known for her architectural projects, collaborated with United Nude to design a pair of shoes printed with a 3D printer. These shoes have unique lines and shapes that would be impossible to create using traditional manufacturing methods [6]. Bags and accessories made with 3D printing are also becoming popular, as they allow for the creation of items with unique geometric shapes and textures [7].

The company Viktor & Rolf is also actively experimenting with 3D printing in its collections. In 2018, they presented the "Fashion Statements" collection, which included 3D-printed elements integrated into traditional fabrics. These elements gave the garments additional structural features, emphasizing the brand's avant-garde style [8].

Despite all the advantages, the use of 3D printing for mass production of clothing faces several challenges. The main one is the rigidity of the materials used for printing. Traditional fabrics possess flexibility, softness, and comfort, making them ideal for creating clothing worn daily. Materials for 3D printing, such as thermoplastics and photopolymers, are much stiffer, which limits the ability to create comfortable clothing, especially for everyday use.

Additionally, for mass production, the development of technologies and materials with the required characteristics, such as flexibility and durability, while remaining easy to manufacture, is necessary. The development of new composite materials that combine the properties of traditional fabrics with the capabilities of 3D printing will be a key factor in implementing these technologies on a broader scale [7].

Despite current limitations, such as material rigidity, the potential of 3D printing in the fashion industry remains vast. In the future, with the development of technologies and materials, one can expect an expansion of 3D printing in the mass production of clothing and accessories. Technologies such as selective laser sintering (SLS), laser stereolithography (SLA), and fused deposition modeling (FDM) already enable the creation of complex and high-quality items. However, to make this technology truly widespread, issues of flexibility and material durability, as well as equipment cost, must be addressed.

The application of 3D printing for creating elements of clothing, footwear, and accessories produced to individual measurements appears particularly promising. This will allow brands not only to speed up the development and production process but also to offer customers a high degree of personalization, which is becoming an important trend in the fashion industry [9].

Thus, 3D printing in the fashion industry represents one of the most promising directions, capable of significantly changing approaches to clothing and accessories production. Currently, 3D printing technologies are actively used for creating unique designer solutions, accessories, and personalized items. However, for the widespread adoption of this technology in clothing production, further development of materials and technologies, as well as a reduction in costs, will be necessary. In the future, 3D printing is expected to become an essential tool in the production process of the fashion industry, especially in niches related to individualized and eco-friendly items.

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VISUAL CONCEPTS OF CONTEMPORARY MAGAZINES AND SIGNIFICANCE OF DESIGN COVERS IN MAGAZINE MARKETING STRUCTURE
(magazines “Teatri”, “Arili”, “ARTFORUM”, “Art in America”)

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Abstract

Media and culture play a pivotal role in shaping public consciousness. Over the years, cultural tastes have been shaped by a complex interplay of social factors, including peer influence. Media has expanded this influence exponentially, creating a new cultural landscape.

Cultural journalism plays a crucial role in fostering an informed and democratic society. In conjunction with the field of culture, it provides the public with essential information to make informed decisions. The degree of societal trust in the media is contingent upon several factors, including the media's independence from governmental and other external influences, its capacity for critical thinking and analysis, its willingness to address open-ended questions, its commitment to verifying information, and its ability to present a range of perspectives and draw logical conclusions. The media's ability to comfort society is contingent upon its adherence to principles of truth, objectivity, impartiality, and promptness. The development of society is inextricably linked to the quality of the media.

The objective of our research is to examine the representation of cultural topics in Georgian and American print media, with a particular focus on two Georgian and two American magazines. The periodicals "**Teatri**," "**Arili**," "**ARTFORUM**," and "**Art in America**" were selected for analysis. This paper will examine the discourse diversity of art in media, with a particular focus on the visual concepts employed in contemporary magazines and the role of the cover in the marketing structures of the aforementioned magazines.

Keywords: media, culture, cover, contemporary magazines, visual concepts

Introduction

As is the case for the entire world, culture and art are significant domains for Georgia. These fields facilitate the intellectual, political, and economic advancement of the nation, and elucidating these subjects has consistently been a pertinent endeavor.

The **relevance** of our paper is determined by the object of our study, namely Georgian and American art magazines. In order to ascertain the relevance of our study, it is necessary to consider the contextual aspects as well as the visual concepts inherent to these magazines.

With regard to the **novelty of research**, this represents the first attempt to undertake a comparative analysis of Georgian and American art magazines, utilizing print media materials.

In this article, we employ the **content analysis** research method and the **contrastive analysis** to examine the visual concepts and impact of cover designs in Georgian and American magazines.

Magazines that are successful in terms of their circulation and revenue streams endeavour to respond in a creative manner to current events. This is evident not only in the content that they publish but also in the design of their covers and the visual concepts that they employ. In light of the accelerated pace of contemporary events, magazine editors frequently encounter the challenge of producing covers at the last minute. The cover serves as a powerful visual identifier for a magazine, making it imperative to create designs that are both striking and memorable. While editorial content is of the utmost importance, commercial considerations must also be taken into account when designing a cover. In certain instances, specific events or individuals may be perceived as particularly newsworthy or commercially relevant at a given moment in time. From the perspective of the photographer, magazine covers convey visual impressions that resonate with readers.

This article will examine the visual concepts employed in research magazines, with a particular focus on the role of the cover as an "introductory word." The most fundamental element of any publication bearing the brand logo is the cover. The cover is the element of the publication that should convey the publication's attitude in an immediately apparent manner. This distinguishes it from other specific magazines. In his book, Newspaper Design, Harold Evans, editor of The Sunday Times, observed that the printed media is a conduit for the conveyance of ideas, and design is an integral component of that process (Evans, 1981).

The effective application of visual journalism, photography, and infographics is a vital component of the success of any magazine. Cover designs can be broadly categorized into three principal types: figurative, abstract, and text-based. Our research indicates that both figurative and abstract covers are employed in academic journals, but text-based covers remain the most prevalent format.

The magazine “Teatri” adheres to a consistent visual and editorial style. Its cover designs are closely aligned with the thematic content of each issue. Besik Danelia is the publication's designer. For illustrative purposes, one may cite the November 2019 issue, which features a portrait of Dante Alighieri, drawn by Sergo Kobuladze, which complements the issue's thematic focus. A portrait essay “A barcode of Kobuladze” by Davit Andriadze is presented in the "Vernissage"

section. Sergo Kobuladze, whose creative methodology demonstrates an affinity with graphic and dynamic principles, frequently draws inspiration from the historical development of art. His adroitness in the use of a pencil to portray Dante Alighieri serves to exemplify this approach." (Andriadze, 2019).

To commemorate its 110th anniversary in 2020, i.e. the magazine was founded in 1910, it featured the cover of its January 1, 1918 issue (magazine "Teatri da Tskhovreba, in *English:* "*Theatre and Life*") on one of its own covers. In the same issue, Levan Bregadze's article, "When Art Spreads Its Wings", is thematically related to the cover. In this article, the author makes the following observation: "Founded in 1910 by Ioseb Imedashvili, "Theatre and Life" magazine featured a distinctive cover design. The upper portion of the cover, which remained consistent across issues, displayed the magazine's title and theatrical symbols. The lower portion, however, was variable, showcasing images of writers, actors, or artistic groups." (Bregadze, 2020).

As Austrian writer Arthur Schnitzler observed, the ultimate objective of all culture is to render politics obsolete and to establish science and art as indispensable to humanity. The cover of the fourth 2020 issue of "Teatri" magazine features a photograph of Julian Roeder from Susan Kennedy and Markus Selg's play Future Society. Furthermore, the same issue includes Sofia Tortladze's "Berlin Diaries" in the "Fiesta" section, in which the author discusses the performance and its connection to contemporary German theater. Furthermore, it challenges Arthur Schnitzler's assertion that culture should render politics obsolete by examining the concept of the Volksbühne. The latter denotes a cultural society that has been cultivated by a political idea (Tortladze, 2020). The covers of various issues feature works by artists such as Anselm Kiefer, Kazimir Malevich, Paul Klee, Nicholas Mirisch, Rezo Gabriadze, and Felix Varlamishvili.

The distinctive cover designs of "Arili" magazine are the consequence of a collaborative endeavour between the editorial team and cover designer Mamuka Tkeshelashvili. The cover of the fifth 2019 issue of Arili features a photograph of the equestrian statue of Roman Emperor Marcus Aurelius, which serves as a thematic complement to Joseph Brodsky's essay "In Honor of Marcus Aurelius", also included in the issue.

The magazine "Arili" introduced Georgian readers to a diverse range of international authors through high-quality translations. Among these authors was Peter Handke, the Austrian writer, playwright, translator, film director, and screenwriter who was awarded the Nobel Prize in Literature in 2019 for his significant contributions to the literary world. The cover of the seventh 2019 issue of "Arili" features a pencil portrait of Handke. This issue also includes a translation of his short story, "Das Umfallen der Kegel von einer bäuerlichen Kegelbahn" translated from German into Georgian by Natia Datuashvili.

The falling of the pins from a rural bowling alleyThe covers of the sixth 2021 and eighth 2022 issues of "Arili" feature portraits of Nobel laureates Louise Glück and Annie Ernaux, respectively. The magazine consistently publishes their work, which often addresses feminist themes and social issues.

In 1962, the American art magazine ARTFORUM was established by John Irwin Jr. Philip Leider was the initial artist to contribute to the magazine, suggesting to Irwin that he should begin to promote local artists and the West Coast School of Art. With the assistance of Pisani Printing Company and editorial oversight from Irvine, the first issue of the magazine was successfully published. The cover was designed by the Swiss artist Jean Tinguely. The current designer and production manager of ARTFORUM is Tina Tran. From July 24 to August 23, 2019, the majority of issues from the 1962 period of ARTFORUM were presented at the Sotheby's New York exhibition in New York. The exhibition was met with considerable interest from art critics, who not only discussed the content of the magazine but also the visual concepts behind its design, including the cover. The cover of the magazine was evaluated as a prospective representation of the evolution of modern art.

The September 2022 issue of "Arili" featured the work of Colombian artist Delcy Morelos. His philosophy, rooted in Andean traditions, posits a deep connection between humanity and the earth. The artist's work, showcased on the magazine's cover, embodies this concept, portraying the earth as both a physical and spiritual center. "In Andean ancestral traditions, the human being is living earth, I am a body, I am earth. In the exhibition space, the earth expresses itself; it is the center and mirror of what we are" (Morelos, 2022). This work by Colombian artist Delcy Morelos, along with his philosophical vision, was featured on the cover of the September 2022 issue of the magazine. Morelos' practice draws inspiration from a synthesis of Andean cosmology and minimalist art aesthetics. The practice of this talented artist has its roots in the cosmic and Andean traditions, as well as in the principles of minimalist art aesthetics. "ARTFORUM" has a particular focus on publishing the works of women artists who are actively engaged in the field. The fifth issue of the magazine, published in 2023, features the work of Brazilian artist Marina Reinganz, renowned for her semi-abstract landscape paintings. The artist's compositions, characterized by a rich chromatic palette, explore the boundaries between abstraction and figuration, evoking a sense of imaginary space.

The cover design and visual concepts of the magazine Art in America are worthy of note for their intriguing nature. The August 2023 issue features a striking image of a woman with a pit bull against a red background. This artwork serves as a contemporary protest against global conflicts, particularly the ongoing wars in Ukraine and Gaza. This period, much like the interwar years of the 20th century, has inspired artists to turn to surrealism to express the horrors of war. While some magazine covers may prioritize commercial considerations, the overall aesthetic of this publication aligns with international art trends and showcases the work of contemporary artists.

Conclusion

This article examines the visual concepts and cover design strategies employed by Georgian and

American **magazines** – "**Teatri**", "**Arili**", "**ARTFORUM**" and "**Art in America**"**.** In the current, highly competitive environment of magazine publishing, marketing represents a critical element in ensuring the financial viability and sustainability of individual titles. While the cover serves as a powerful marketing tool, it also functions as a first impression, influencing the reader's initial perception of the publication.

In contrast to the Georgian publishing industry, which often prioritizes the mere act of survival, the American industry is more reader-centric. Every aspect of magazine production, from the design of the cover to that of the interior layout, is planned and executed with great care and attention to detail. Major publishers, who invest considerable resources in cover design, even when more cost-effective alternatives are available, recognize the essential function of the cover in both marketing and content. The cover is the primary visual identifier for a publication.

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BIOLOGICAL SCIENCES

GERMİNATİON FEATURES OF ROBİNİA LUXURİANS (DİECK) C.K.SCHNEİD SEEDS UNDER ABSHERON CONDİTİONS

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Abstract

Plants do not produce the same amount of fruits and seeds every year. In this regard, one of the important issues is to collect seed stock for the coming years by calculating fruit and seed productivity of plants. Since the main indicator of seed quality is seed germination, the study of seed germination of introduced plants is of both theoretical and practical importance. The study of the period of seed viability preservation is also of great scientific and experimental importance.

Keywords: seed, quality indicators, germination characteristics, viability

The main quality indicator of seeds is their germination features, so the study of the germination characteristics of seeds of the plants introduced has both theoretical and practical importance. Moreover, the study of the preservation period of seed viability has great scientific and experimental importance [1, 2, 3, 10].

Cultivation and reproduction of the plants introduced in new fields is cheaper with their own seeds, and adapt faster to the current environmental conditions [5, 6]. Considering this, the aim was to study the germination features of Robinia luxurians (Dieck) C.K.Schneid seeds introduced to the Absheron Peninsula. During the research, the seeds were placed for germination in thermostats at different temperatures (20-30^{0}C), and germinated after being processed with chemical and mechanical scarification methods [3, 4, 7, 8, 9]. In the study on the germination of magnificent robinia seeds under different temperature conditions, found that 20^{0}C was more suitable for seed germination. So 59% of the seeds placed for germination germinated under these temperature conditions. Found that the germination period of the seeds depended on the temperature. So the germination period of the seeds placed for germination at 20 0 C was 14 days and at 25-30 0 C was 17 days.

When magnificent robinia seeds are sown unprocessed before sowing in autumn and spring, they sprouted fewly. That's why, these seeds need to be prepared before sowing to accelerate their germination. There is information about preparing these seeds for sowing by different methods: mechanical damage, acid and boiling water [7, 9, 10]. In our experiments on the germination of magnificent (great) robinia seeds, along with the control seeds, the seeds kept in boiling water for different periods (5 sec., 15 sec., 30 sec., 1 min., 5 min., 10 min., 30 min.) were placed in a thermostat for germination at a temperature of 20^{0}C. The experimental conclusions showed that magnificent robinia seeds germinated up to 94% when kept in boiling water for 15 seconds before germination. But noted that, as in all options, seeds kept in hot water for 15 seconds needed to be processed with hot water again for the same period to germinate better. After the first proccess, the germination of control seeds was 3%, while the germination of hot water proccessing options was 13-50%, depending on the option (5 sec., 15 sec., 30 sec., 1 min., 5 min., 10 min., 30 min.). After the second proccess, 28% of the seeds germinated, finally, after the third proccess, 16% germinated. Thus, by boiling great robinia seeds 3 times for 15 seconds, 94% germination may be obtained. For this, after proccessing the seeds in hot water, every time the seeds swollen should be separated and placed for germination, and repeated this procedure on the remaining non-swollen seeds for 15 seconds. Thus, noted that to prepare the magnificent robinia seeds for sowing, they should be processed with boiling water for 15 seconds before sowing. In doing so, seeds germinate quickly and massively (94%).

One of the pre-sowing processing methods to prepare the seeds for sowing is processing with solid sulfuric acid. The main goal of this method is to soften and make the hard coat of the robinia seeds porous. In this case, the soft and porous seed coat ensures water and gas exchange between the embryo and the environment [7, 8]. To determine the duration of solid sulfuric acid processing of magnificent robinia seeds, selected good seeds of the species were placed in a thermostat (20^{0}C) after processing with acid in different variants (5 min., 10 min., 20 min., 40 min., 60 min., 90 min., 120 min.), and their germination were observed. Observation and calculations have shown that when the magnificent robinia seeds are processed with strong sulfuric acid, not all of them germinate. This is due to the different degrees of maturity of the seeds and the thickness and hardness of their coats. So after processing with strong sulfuric acid for 5-120 minutes, the germination percentage of magnificent robinia seeds is 21-51%, depending on the variant. The highest germination rate after the process is seen in a period of 60-120 minutes with 42-51%. Germination is 21-37% in the remaining options. All the seeds in a period of 60-90-120 minute germinated after the seeds ungerminated are processed with solid sulfuric acid for the second time pursuant to the above options. The seeds in the 5-10-20-40 minute options germinated 6-45% depending on the option. In these variants (5-10-20-40 min), when the remaining seeds are processed with acid for the third time, they germinate completely. Thus, if it is enough to process the magnificent robinia

seeds twice for 60-120 minutes before sowing with sulfuric acid, processing of three times for 5-40 minutes are necessary. After processing with strong sulfuric acid, the magnificent robinia seeds have a germination period of 35 days. That is, the seeds germinate 21-51% in 35 days, depending on the variant. After the second process, the seed germination period is 7 days, and after the third process - 5 days. Thus, after processing the magnificent robinia seeds with solid sulfuric acid in different variants, determined that 60-120 minutes is the most optimal time for their rapid and massive germination. That's why, the magnificent robinia seeds should be kept in strong sulfuric acid for 60-120 minutes before sowing, and then the swollen seeds be separated and sowed, and the remaining seeds unswollen be sowed after processing with the same rule for the second time. If this rule is followed, rapid and large-scale sprouts from great robinia seeds may be obtained.

The need for light for seed germination varies among plant species. The seeds of most plants germinate well in a darkness under the soil [2, 3, 10]. To determine the role of light in the germination of magnificent robinia seeds, the seeds were placed in a thermostat to germinate in the light and dark at 200 C. The experiment showed that at the beginning of seed germination, the germination percentage of seeds in the dark was twice as high as in the light conditions, and at the end of the experiment, the germination percentage of seeds in both variants was equal. Thus, darkness is required for the first phases of germination of the magnificent robinia seeds, and lightness for the later ones.

We processed the seeds with some organic compounds to remove the thin resinous layer on the surface of the magnificent robinia seeds. The conclusions showed that though processing magnificent robinia seeds with acetone (within 10 min., 20 min., 30 min., 40 min., 50 min., 60 min., 120 min.) and hydrogen peroxide (5 min., 10 min., 20 min., 40 min., 60 min.) before they are placed for germination shortens germination time somewhat, the germination percentage of the seeds remains constant. Found that magnificent robinia seeds should be processed with acetone or hydrogen peroxide before sowing to shorten the germination time.

Studies have shown that, magnificent robinia seeds retain their germination ability for 3-4 years depending on storage time. After this period, their germination ability falls down significantly. The germination percentage of seeds stored for 7-8 years is no more than 20-30%. That is why, fresh seeds of the magnificent robinia for sowing should be used. Thus, noted that to obtain massive (94%) sprouts from magnificent robinia seeds, they should be processed before sowing. For this, the seeds must be kept in hot water for 15 seconds every time, repeating three times, or after processing with solid sulfuric acid for 60-120 minutes, be placed in a thermostat (or soil environment) for germination at a temperature of 20^0C. To shorten the germination period of seeds, they should be processed with acetone or hydrogen peroxide before sowing. In this case, it is possible to obtain a large number of sprouts from the magnificent robinia seeds shortly and to prepare the necessary amount of planting material for cultivating representatives of this species in larger areas.

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STRUCTURE OF TAPETAL CELLS OF BARLEY (HORDEUM VULGARE L.)

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Abstract

Tapetal cells, like other parietal layer cells were small and oblong in the beginning. Shortly afterwards they incvcased in size and became binucleate, their cytoplasm being densely staincd with haematoxylin. Not a fow cells of the tapetum showed chromatin qranules in their nuclei. At the pollen tetrad stage, the tapetal cells had attained their maximum growth.

The submicroscopic structure of the tapetal cells of the barley anthers has been investigated at the stages of a late tetrad and uninucleate pollen qrain before and after vacuolization. The tapetal cells of the barley as regards their structure and functions at these stages of development may be characterized as secretary ones. Their cytoplasm is abundant with cell organells. Numerous mitochondria and a Golgi apparatus are in close vicinity with the cisterns of an endoplasmic reticulum. The presence of ribosomes on the onter cisternae of the stack relates the entire structure to the endoplasmic reticulum. Ocmiophilic substances apper in several places with respect to the tapetal cells. At the stage of an uninucleate pollen grain instead of the degenerated primary walls, surrounding every tapetal cell, a new wall is formed, which consists mainly of sporopollenin.

Keyword: barley, tapetum, ultrasturkture, anther, organelles, development.

Introduction

The mature anther wall consists of several layers: epidermis, endothecium, middle layer and tapetum. These layers differ in cell structure and fulfil a specific function [11,12,20], Tapetal cells of plant anthers are rich in proteins, fats, starch, amino acids, enzymes and hormones [6,10]. The presence of these substances in tapetal cells indicates their high physiological activity, which is characteristic of secretory cells.

Various cell organelles are involved in the formation and transport of secretion products in secretory cells, including tapetal cells of cereals. Examples of localisation of various substances, their secretion and transport in the cisternae of the endoplasmic reticulum are given in the literature. Along with the endoplasmic reticulum, dictyosomes are also the site of secretion synthesis and transport.

The present work presents the results of the study of ultrastructural changes in barley tapetum cells from the time of establishment to their degeneration.

Material and methodology

Barley (Hordeum vulgare L.) anthers were examined. The material was fixed with 2.5% glutaric aldehyde in phosphate buffer pH-7.2 for 3 hours. Then anthers were additionally fixed in 2% OsO4 solution. Casting was carried out in epon 812. Sections were prepared using an LKB ultramicrotome and contrasted with lead citrate according to Reynold's method. Sections were examined using a JEM-7 electron microscope.

Research results

The outer wall of each of the four microsporangia of the barley anther consists of epidermis, endothecium, middle layer and tapetum. The tapetum of barley anther consists of a single layer of cells and completely surrounds the sporogenic cells. The ultrastructure of tapetal cells changes during differentiation and secretion.

Tapetal cells at the stage of secondary archesporium formation are connected with each other and with sporogenic cells by plasmodesmata. The nuclei of tapetal cells on sections are round or oval. The outer nuclear membrane is granular and very often connected to the endoplasmic reticulum /ER/. Tapetal cells at the secondary archesporium stage are rich in cytoplasmic organelles. Mitochondria are numerous. They are heterogeneous in size, both small and large ones are found. In each mitochondrion, usually 3-4 cristae are found. Mitochondria are evenly distributed throughout the cell volume.

Plastids have the highest electron density. The profile of plastids is elongated, oval. Some plastids contain a small starch granule. The ER is strongly developed. Numerous membranes anastomose with each other. The surface of the ER channel is densely and evenly covered with ribosomes. The Golgi apparatus is rare. Dictyosomes consist of 4-5 paired membranes. Few small Golgi vesicles are detached from the edges of the dictyosomal cisternae and are observed at the terminal ends of the dictyosomes and near them in the cytoplasm.

In the course of further anther development, changes in the structure of organoids of tapetal cells occur. During the formation of microsporocytes, the density of cytoplasm matrix increases. The nucleus with a clearly distinguishable nucleus, occupies the central part of the cell. The matrix of mitochondria is electronically dense. The number of cristae has increased, the number of cristae reaches 6-7 per mitochondrial slice. Plastids of tapetal cells can be oval, round, elongated with electron-dense matrix. Some plastids contain a single starch granule. Long ER channels surround the nucleus and sometimes form a concentric membrane-ergastoplasm. In the meiosis phase, the number of Golgi apparatus elements in the cytoplasm of tapetal cells has markedly increased compared to the previous stage. Each dictyosome consists of 4-5 cisternae surrounded by numerous vesicles of different size with granular content. Large vesicles are located throughout the cytoplasm and near dictyosomes, their content is

electron-transparent. Small vesicles with grey content are located only at the terminal ends of dictyosomes.

At the stage of formation of tetrads of microspores, the inner tangential sheath of tapetal cells thickens. The radial wall adjacent to it is also partially thickened. In this phase of anther development, the tapetal cells form proorbiculae-grey bodies located between the tapetal cell sheath and the plasmalemma. Later, sporopollenia are deposited on the proorbiculae and they become orbiculae. The cytoplasm of tapetal cells at the stage of formation of tetrads of microspores differs in ultrastructure from the previous stages. The mitochondria of the tapetum at this stage are rounded or oval in shape and contain 2-4 rather narrow, long or sickle-shaped cristae. Narrow long ER channels are strongly developed at the tetrad stage. The size of the plastids has increased. In earlier phases, up to the tetrad stage, plastids did not contain osmiophilic globules. At this stage they contain starch granules and numerous osmiophilic globules. At the tetrad stage of microspores, tapetal cells are characterised by maximum development of the Golgi apparatus.

As the microspores emerge from the tetrads, the tapetum begins to degenerate. The disorganisation of organelles continues during the development of the uninucleate microspore and is completed at the stage of the two-cell pollen grain. However, the development of a single-nucleated pollen grain is rather long and we have conditionally divided it into three stages.

At the stage of early vacuolisation of microspores, lysis of the inner tangential sheath of tapetal cells, previously somewhat thickened, occurs. Proorbiculae are formed between the tapetal sheath and the plasmalemma. Subsequently, sporopollenin is deposited on the proorbiculae and they become orbiculae. At this stage, the ER is strongly developed. The other organelles do not differ significantly from those at the tetrad stage.

At the stage of late vacuolisation of microspores, when a central vacuole is formed in the pollen grain, the inner tangental and radial sheaths of tapetal cells practically disappear, sometimes only the middle lamina remains. Tapetal cells contain one or two oval-shaped nuclei. Chromatin is not evenly distributed throughout the nucleoplasm. Individual clots of chromatin are adjacent to the nuclear envelope. The nucleus is usually oval in shape, located in the centre of the nucleus or displaced to its periphery.

Thickening of the cytoplasm matrix of tapetal cells indicates the beginning of cell degeneration.

Signs of degeneration are associated with a decrease in the number of ribosomes, disorganisation of ER, cisterns of dictyosomes and destruction of part of mitochondria. The latter at this stage contain strongly swollen cristae resembling rounded bubbles in their shape. By the time of tapetum cell destruction, most plastids lack starch granules, only some plastids carry large starch granules. The long channels of the ER are fragmented and disintegrate into short sections. Its membranes partially lose ribosomes. Dictyosomes consist of 4-5 closely appressed parallel cisternae, with small vesicles near the ends of the cisternae. Sporopollenin continues to accumulate on the surface of each orbicle. The matrix of the cytoplasm of tapetal cells is now entirely electron-transparent. By the time of formation of a two-celled pollen grain, disintegration of the cytoplasm of tapetum cells is completed. After disintegration of the cytoplasm of tapetal cells, a tapetal film remains in the anthers, which is fully formed by the time of formation of a uninucleate pollen grain with a central vacuole. The tapetal film, which is of sporopollenin nature, covers the entire tapetal cell like the exine of pollen grains.

Our electron microscopic study allows us to describe in detail the ultrastructure of actively secreting tapetum cells during the period when sporopollenin shells with their constituent orbiculae are formed. All sporopollenin sheaths are formed in the tapetal cell during the period of formation of the uninucleate pollen grain. The sporopollenin-secreting cells of barley tapetum are characterised by a strong development of rough ER, high electron density of the hyoloplasm, a large number of dictyosomes, and the appearance of osmiophilic particles and starch grains in the plastids.

Thus, by the time pollen grains mature, tapetum development ceases. The following ultrastructural peculiarities are indicators of degeneration in tapetum cells, preceding complete lysis of cytoplasm: electron-transparent hyoloplasm, decrease in the number of free ribosomes, formation of autolytic vacuoles, shortening of ER channels, merging of plastids and ER, the latter sometimes surrounding them. The exit of osmiophilic bodies beyond the plasmalemma along the radial walls was noted.

In the mature anther, only the sporopollenin sheath (tapetal film) with orbiculae included in its composition remains from the tapetum.

Discussion of results

A number of researchers have established that the tapetum plays an important role in normal pollen development, since all substances entering the sporogenic cells must inevitably pass through the tapetum [8,9,10,17,18,19,22,24]. The ultrastructure of differentiated tapetal cells of barley anthers is generally similar to that of secretory cells of other plants [5] and animals [15]. This similarity is particularly clear in the number and arrangement of the ER, the membranes of which often form an ergastoplasma. Unusual enlargement of endoplasmic reticulum was also found in tapetal cells of other plants: Sileno [15], beta vulgare [16].

A large number of granular ER is characteristic of protein-producing cells. The development of ER in tapetum cells may be associated with the realisation of a similar function. As is known, the tapetum borders the tissue of microspore mother cells and developing pollen grains. These cells must accumulate substances used in their development. Fragmentation of ER cisternae and vesicle formation during tapetal cell degeneration may be related to the processes of movement of spare substances. ER channels mediate the transport of protein hydrolysis products and are also the site of enzyme synthesis. The disintegration of ER can also lead to the release of hydrolytic enzymes.

The function of the Golgi apparatus is probably also related to the secretory activity of the tapetum[1]. At different stages of anther development, the Golgi apparatus is similar to the ER in the nature of its changes. During differentiation of tapetal cells, the number of

Golgi apparatus components on a slice increases and reaches a maximum at the tetrad stage. Similar data were obtained when studying tapetal cells of other plants [13]. In other plant cells, it was found that the number of dictyosomes, their total size, and the nature and size of vesicles detached by dictyosomes change in the process of cell differentiation depending on tissue specialisation and functional load of organelles [2].

The content of a large number of dictyosomes in tapetal cells indicates that synthetic processes are intensively taking place in barley tapetal cells. In meristematic cells mitochondria have weakly contrasting membranes, cristae are few. As cells differentiate, cristae develop, the contours of the outer and inner membrane with cristae become sharp. The number of cristae tends to increase [3]. As cells age, mitochondrial cristae undergo reduction and destruction [23]. The morphological changes of mitochondria during tissue differentiation are probably related to changes in the physiological state of the cell [4].

During anther development in barley tapetal cells, we found the same change in mitochondria.

We observed a large number of free ribosomes in barley tapetal cells. A detailed picture was observed by Echlin and Godovin [13].

In the mature anther, only the sporopollenin sheath /film/ with its constituent orbiculae remains in the tapetum cells [14,21,25]. It has been established that in cereals, orbiculae serve as a place of attachment of pollen grains [7].

Conclusions

1. Tapetum cells in the developing anther in the process of formation of secondary archesporium, meiocytes and pollen grains from meristematic cells become secreting cells, then their cytoplasm undergoes lysis.

2. Each stage of the developing tapetal cell is characterised by a specific ultrastructure.

3. In the mature anther, only the sporopoyalenin sheath formed during cell development, with its constituent orbiculae, remains.

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COMPARATİVE ANALYSİS OF THE FLORA OF THE ABSHERON PENİNSULA AND THE OİL-CONTAMİNATED FLORA OF AZERBAİJAN

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Abstract

The wild flora polluted by oil, as well as oil products and groundwater in Azerbaijan, was formed by the geographical location of the mines, relief, soil-ecological conditions, anthropogenic factors and technogenic effects.

In the "Siyazanneft", "Absheronneft" Oil and Gas Extraction Department (NGPC), as well as in the "Buzovna-Mashtaga field" and "Babazanan oil field", as well as in the research objects of the State Oil Company of Azerbaijan (SOCAR), salinized gray-brown, gray-brown grass , the flora contaminated with oil in saline, sandy and marshy soils was studied.

Keywords: taxon, family, genus, species, endemic, subendemic.

"Synopsis of the flora of the areas polluted by oil and oil products in Azerbaijan" was prepared for the first time based on the results of floristic studies conducted in 2021-2024 together with phytoecological studies.

According to A. Akhundova, from the analysis of the wild flora of the Absheron peninsula and the flora of oil-polluted areas in Azerbaijan, it is found that 501 species belonging to 69 families and 301 genera are found in the wild flora of the peninsula. (table 1)

Table 1

Taxa and life forms	In Flora of the Absheron Peninsula		In the flora of oil-contaminated areas in Azerbaijan	
	quantity	in %	quantity	in %
Family	69	100	39	56,5
Genus	301	100	134	44,5
Species	511	100	187	36,6
Tree, shrub, semi-shrub, bush, half bush	56	100	34	60,7
Herbs (multiennial, annual, biennial)	451	100	153	33,9

As shown in Table No. 1, the flora of oil-contaminated areas in Azerbaijan includes 39 families, 134 genera and 187 species according to systematic taxa, as well as shrubs, semi-shrubs, shrubs, semi-shrubs (with 34 species); grasses are represented, including perennials, biennials and annuals (with 153 species).

The analysis of the flora of the oil-contaminated areas in Azerbaijan according to systematic taxa shows that 9 families with the largest number of genera are quantitatively superior. As mentioned, Chenopodiaceae, Asteraceae and Poaceae families occupy the first, second and third place in terms of quantity.

In this sense, it corresponds to the first place (17 breeds) or 12.7%, the second place (17 breeds) and the third place (21 breeds) or 15.7%. Chenopodiaceae (29 species), Asteraceae (24 species) and Poaceae participate in the systematic structure with 22 species or 11.8%. Plant life forms or biomorphs [18, 14, 10] are identified in the flora of the investigated oil-contaminated mining areas.

From the biomorphological analysis, it was found that 103 species (55.1%) of therophytes, 34 species of hemicryptophytes (18.2%) and 21 species of chamephytes (11.2%) are found in the wild flora of oil-polluted areas.

We identified the plants distributed in the flora of the investigated oil-contaminated mining areas according to five ecological groups [10] based on their water demand. The ecological group of oil-polluted flora consists of xerophytes 111 species and halophytes 37 species, mesoxerophytes 24 species, mesophytes 8 species and hydrophytes 7 species.

According to the studies [17, 6, 7] on the presence of endemic and subendemic species spread in the oil-polluted flora of Azerbaijan, the species included in the "Red Book" have been listed.

The investigation of oil-contaminated flora in Azerbaijan from endemic and subendemic point of view is of important phytoecological importance. Thus, Caucasian endemics (13 species) make up 2.3% of endemics in the flora of the republic, Azerbaijani endemics with 9 species (5.0%) and subendemics with 7 species (1.7%). According to literature information, 7 species (2.6%) of rare, endangered species whose names are included in the "Red Book" [2, 3] have been identified in the flora of the studied oil-contaminated areas.

In general, the names of plants found in the wild flora of oil-polluted areas are represented by 2.6% of the species included in the "Red Book of Azerbaijan".

Planting of the above-mentioned endemic, sub-endemic and main species listed in the "Red Book", especially ecomorphic plants, in the biological reclamation of oil-contaminated lands in Azerbaijan is purposeful. In this regard, measures should be taken to restore the wild flora of oil fields.

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SOİL COVER ANALYSİS OF THE MOUNTAİNOUS PART OF TALİSH

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АНАЛИЗ ПОЧВЕННОГО ПОКРОВА ГОРНОЙ ЧАСТИ ТАЛЫША

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Abstract

As indicated in the map "Morpho-genetic profile of Azerbaijani soils", "Modern classification of Azerbaijani soils" and "Ecological assessment of agricultural soils of Lankaran-Astara natural-economic region", the soil types, subtypes, genera and species diversity of the area, geographical distribution, genetic structure, detailed information on color profile, physical and physico-chemical properties is given.

Based on our research, it was determined that the highland part of the area consists of three zones: mountain-meadow, mountain-meadow-steppe, mountain-forest-brown, mountain-brown, and meadow-swamp land.

Аннотация

Как указано в картах «Морфо-генетический профиль азербайджанских почв», «Современная классификация азербайджанских почв» и «Экологическая оценка сельскохозяйственных почв Ленкорань-Астаринского природно-экономического района», типы, подтипы, роды и видовое разнообразие почв Приводятся ареал, географическое распространение, генетическая структура, подробная информация о цветовом профиле, физических и физико-химических свойствах.

На основании наших исследований установлено, что высокогорная часть ареала состоит из трех зон: горно-луговой, горно-лугово-степной, горно-лесо-бурой, горно-бурой и лугово-болотной.

Keywords: Mountain-meadow soils, mountain-meadow-steppe soils, humus, clayey soils
Ключевые слова: Горно-луговые почвы, горно-лугово-степные почвы, гумус, глинистые почвы.

Луговые и лугово-степные почвы субальпийского пояса.

Горно-луговые почвы– *Distrik regosols.* Почвы этого типа формируются в экосистеме горной части Талыша и занимают обширную территорию. Распространенные в регионе горно-луговые земли занимают площади на высоте от 1800 до 2500 м над уровнем моря. Основной характерной особенностью типа является его богатство органическим веществом, а также субальпийская растительность, распространяющаяся по почве, и травы, образующие многолетние травы, обеспечивающие плодородие почвы [4,2]. В частности, количество гумуса в травянистых горно-луговых почвах (в верхнем слое) достигает 11,3-14,7% [6]. Однако в горной части Лерикского района количество гумуса в почвах горно-лугового типа колеблется в пределах 4,90-6,70% [6,3].

Морфологические характеристики горно-луговых почв выражены в соответствии с условиями обработки. На этих землях наблюдалось сильное запесчанение и размывание верхнего слоя почвы. Эти земли очень разделены на генетические слои. Гранулометрический состав легко-среднесуглинистый, встречаются щебнистые некарбонатные почвы, мощность колеблется в пределах 50-100 см.

В таких почвах протекают сильные эрозионные процессы средней и тяжелой степени [4, 5, 8]. В этом смысле ускорение эрозии зависит от нарушения гумусового слоя горно-луговых почв. Эти земли в основном используются в качестве летних пастбищ в Ярдымлинском, Лерикском и Астаринском районах. В частности, около 40-45% высокогорной территории на летних пастбищах региона лишено горных сооружений и превращено в скалы, отроги и овраги.

Горно-лугово-степные земли – *Haplic phaeozems.* Этот тип почв широко распространен на высотах и склонах субальпийской лугово-степной зоны (Талышские горные системы), расположенных на высоте 2000-2100 м над уровнем моря [1,9] в субальпийском поясе, а также в Пештасарские горы [3, 15, 14]. В зависимости от рельефа почвы различаются по степени развития, мощности профиля, скелету и количеству гумуса [21]. Так, они различаются по количеству гумуса в мощных и менее скелетных почвах; Высокие, скелетные почвы, формирующиеся на крутых и

маловлажных склонах, малогумусны и более склонны к эрозии [5,18].

Гранулометрический состав горно-лугово-степных почв тяжелый и среднесуглинистый. В частности, количество физической глины колеблется в пределах 32,3-62,0%, а частиц - в пределах 12,7-15,48%. Известно, что гранатовые частицы почвы были смыты вследствие воздействия эрозионных процессов и количество ранее упомянутых показателей значительно снизилось.

Гумус, который является показателем плодородия соответствующего типа почв, в профиле неэродированных горно-лугово-степных почв составлял 5,80-1,20%, в эродированных, наоборот, - в пределах 2,98-1,0%. . В связи с этим были также определены различия в количестве общего азота и общего фосфора [3,13]. При этом в неэродированном типе почвы общее количество поглощенных оснований составляло 45,20-47,85 мг.экв (на 100 г почвы) в верхних слоях, а в эродированных - 25,20-27,90 мг. экв.

Так, в горной части Талыша исследованные горно-луговые луговые почвы распространены лишь на юго-востоке Лерикского района, и в этих почвах встречается фитоценоз кустарников.

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ECONOMIC SCIENCES

INTANGIBLE CULTURAL HERITAGE IN GEORGIAN TOUR OPERATORS' OFFERINGS

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Abstract

This study examines the role of intangible cultural heritage in the offerings of Georgian tour operators. Additionally, the research investigates the challenges faced by providers of intangible cultural heritage services. The study is based on qualitative research conducted with inbound tour operators and intangible cultural service providers in Tbilisi and Batumi. The results reveal the equal importance of both tangible and intangible heritage in Georgian inbound tour operators' offerings. The study identifies only partial utilization of Georgian monuments listed in UNESCO's World Intangible Cultural Heritage in tour operators' programs. It emphasizes the positive role of commercial activities related to intangible heritage in raising awareness about intangible cultural monuments. Overall, the study suggests that there is a need for greater promotion of intangible cultural heritage, education and awareness-raising among the public, efforts to increase the recognition of intangible cultural heritage, and establishing closer connections between tour operators and intangible cultural heritage service providers.

Keywords: Cultural tourism, inbound tourism, Georgian intangible cultural heritage.

Introduction

Georgia has traditionally been an attractive country for tourists, as evidenced by the statistics of visitors and tourists arriving in the country over the past decades. Due to the country's geographical, natural, cultural, and historical-ethnographic diversity, various forms and types of tourism are successfully developing in Georgia. It can be confidently stated that cultural tourism is the traditional and most attractive form for Georgia, with a long history. Based on research conducted in our country, as well as international experience, it can be boldly said that at least half of the international tourists coming to the country are cultural tourists. (G. Kuparadze, Cultural Tourism, Tbilisi, 2022)

However, regarding cultural tourism, as in many countries worldwide, there are many unanswered questions in Georgia as well. Specifically, how are cultural tourists accounted for? Is the statistics based on a broad, activity-based definition of cultural tourism, or a narrower, motivation-based definition is used? Which segment of cultural heritage represents a more significant attraction factor for international or domestic tourists? What are the main characteristics and current trends of the cultural market in Georgia? However, research and analysis of the tourist market is a necessary condition for providing correct recommendations to tour operators and tourist service providers. Unfortunately, there is an acute shortage of such research in Georgia. Moreover, in Georgia's reality, there is no research that would show the transformation of tourist firms' offerings in terms of the intensity of displaying intangible cultural heritage (ICH) over the past thirty years.

Review of Georgian and Foreign Literature

The following UNESCO publications on intangible cultural heritage were used to prepare the article:

1. UNESCO, Identifying and Inventorying Intangible Cultural Heritage, (URL: https://ich.unesco.org/doc/src/01856-EN.pdf)
2. UNESCO, Guidance note for inventorying Intangible Cultural Heritage, 2017 (URL: https://ich.unesco.org/en/guidance-note-on-inventorying-00966)
3. UNESCO, Basic texts of the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage, 2022, (URL: https://ich.unesco.org/doc/src/2003_Convention_Basic_Texts-_2022_version-EN_.pdf)
4. UNESCO, Toolkit for requesting International Assistance from the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage 2022 Edition (URL: https://ich.unesco.org/doc/src/53724-EN.pdf)
5. The United Nations World Tourism Organization (UNWTO) published a comprehensive study in 2012, which represents a baseline study on the connections between tourism and intangible cultural heritage (ICH). In addition to studying the main challenges, risks, and opportunities for the development of ICH-related tourism, it examines practical steps for developing, managing, and marketing tourism products based on intangible cultural heritage. (World Tourism Organization (2012), Tourism and Intangible Cultural Heritage, UNWTO, Madrid. URL: https://www.e-unwto.org/doi/book/10.18111/9789284414796)
6. In a publication issued by the World Tourism Organization in 2018, which deals with the synergy of tourism and culture, a study is presented in which both

member states and experts participated. This study mainly concerns the share of cultural tourists in total tourist flows, the motivations of cultural tourists, and the importance of tangible and intangible cultural heritage. It also provides a new definition of cultural tourism. (World Tourism Organization (UNWTO), Tourism and Culture Synergies, 2018, URL: https://www.e-unwto.org/doi/book/10.18111/9789284418978)

Legislative acts adopted in Georgia regarding intangible cultural heritage:

1. National Agency for Cultural Heritage Preservation of Georgia, Registration Card for Intangible Cultural Heritage Object/Monument (URL: https://www.heritagesites.ge/uploads/files/5b7e9011839d6.pdf)
2. Resolution №303 of the Government of Georgia of July 1, 2016, "On Approval of Culture Strategy 2025" (URL: https://www.matsne.gov.ge/ka/document/download/3328805/0/ge/pdf)
3. On granting the status of an intangible cultural heritage monument to objects valuable from the perspective of cultural heritage. (URL: https://matsne.gov.ge/ka/document/view/4897243?publication=0)

Research Goal and Objectives

The goal of research is to analyze the offerings of intangible cultural heritage in programs prepared by Georgian tour operators for foreign tourists. In modern cultural tourism, the demonstration of intangible culture occupies an increasingly important place. If in the previous century priority was given to monuments of material culture, now the presentation of the nation's spiritual culture has become the primary goal of cultural tourism

The Essence of Intangible Cultural Heritage

Intangible cultural heritage is the knowledge and skills that are passed down from generation to generation and from person to person. Consequently, these forms of culture have an identity-forming effect. It is an opportunity to rediscover our cultural memory and, accordingly, the importance of communities, and not to stop at individualism and performance-oriented thinking. (Gigi Kuparadze, Niko Kvaratskhelia, Some aspects of historical connections from hydrothermal public baths to the modern spa industry, 2022)

Intangible cultural heritage is embodied in the practice, expressions, knowledge, and skills, as well as related objects and cultural spaces, which communities and individuals recognize as part of their cultural heritage. Transmitted through generations and constantly recreated, it gives humanity a sense of identity and continuity. (World Tourism Organization, Tourism and Intangible Cultural Heritage, UNWTO, Madrid, 2012)

A study conducted by UNWTO in 2018 with the participation of member countries, found that the main priority in cultural tourism is product development. The most important aspect of this type of tourism product is tangible and intangible cultural heritage.

From the previous century to the present day, priority has been given to monuments of material culture, especially in terms of recognition, but some experts of the World Tourism Organization believe that now the presentation of the nation's spiritual culture has become the primary goal of cultural tourism. It is especially noteworthy that intangible cultural heritage is considered as the most effective means of tourists' repeated travel (revisits). As stated in the UNWTO study, "Places with monuments of material cultural heritage attract visitors, but only once, unless this material heritage resembles the changing exhibitions of the Guggenheim. Probably very few people travel the world to see the Taj Mahal or the Alhambra twice. Thus, cultural tourism differs from trips aimed at seeing an attraction once and putting a 'plus'. Cultural tourism has much more to do with intangible heritage because it is more flexible than material heritage. The latter can evoke initial charm but it cannot create a sense of loyalty and deep connection." (World Tourism Organization (UNWTO), Tourism and Culture Synergies, 2018) Thus, in modern cultural tourism, the importance of intangible cultural heritage will steadily increase.

On the one hand, there is a growing interest in intangible cultural heritage, and on the other hand, there are no more or less convincing studies and proper market analysis. Therefore we, a small group of professors and students from Grigol Robakidze University's Tbilisi and Batumi representations, set a goal to contribute our small part to solving this problem and to study the programs of tour operators operating in two major tourist centers of Georgia, Tbilisi and Batumi, to determine how much attention they pay to intangible cultural heritage. We focused particularly on those inbound tour operators who are united in the Georgian Incoming Tour Operators Association (GITOA). However, tourist companies that are members of the Georgian Tourism Association also participated in the study. In addition, we investigated providers of intangible cultural services (museums, art centers, Batumi Boulevard, Georgian dance and song ensembles, Tbilisi sulfur baths, and others).

Intangible Cultural Heritage as the Object for Tourism Investigation

The foundation of cultural tourism in Georgia is its tangible and intangible cultural heritage. As of September 2024, there are 7,942 registered immovable cultural heritage monuments in Georgia, 596 movable monuments, and only 72 intangible cultural heritage monuments. (National Agency for Cultural Heritage Preservation of Georgia, 2024) Such a small number of the latter is due to the slow pace of registration, the complexity of the registration forms, and other factors.

In Georgia's "Law on Tourism," Article 3 – "State Policy in the Field of Tourism" – Paragraph B states: "Determination of priority directions in tourism and development assistance." (Law of Georgia on Tourism, 2023) In our opinion, intangible cultural heritage should be a priority direction because what leaves a lasting impression on a tourist's memory is what they experience through all five senses.

Research Approaches

Qualitative research of tourist companies and cultural tourism service providers was carried out through two different pre-prepared questionnaires. As

an exception, several other in-depth interviews were conducted as well.

Research Progress and Results

The research was conducted in Tbilisi and Batumi, in two most popular tourist cities.

I. **Results of Tour Operators' Survey in Tbilisi and Batumi:**

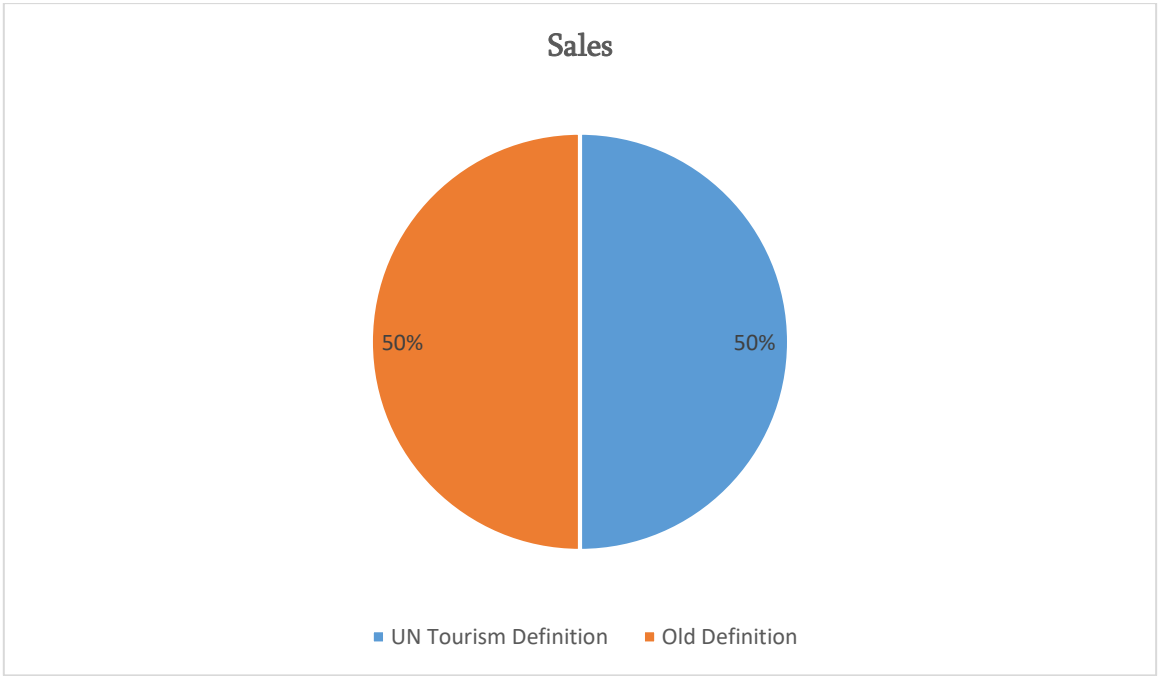
1.1 To the first question: Which definition of intangible cultural heritage would you prefer?

a. Intangible heritage is the practices, representations, expressions, knowledge, skills, as well as the instruments, objects, artifacts, and cultural spaces recognized by communities, groups and, in some cases, individuals as part of their cultural heritage.

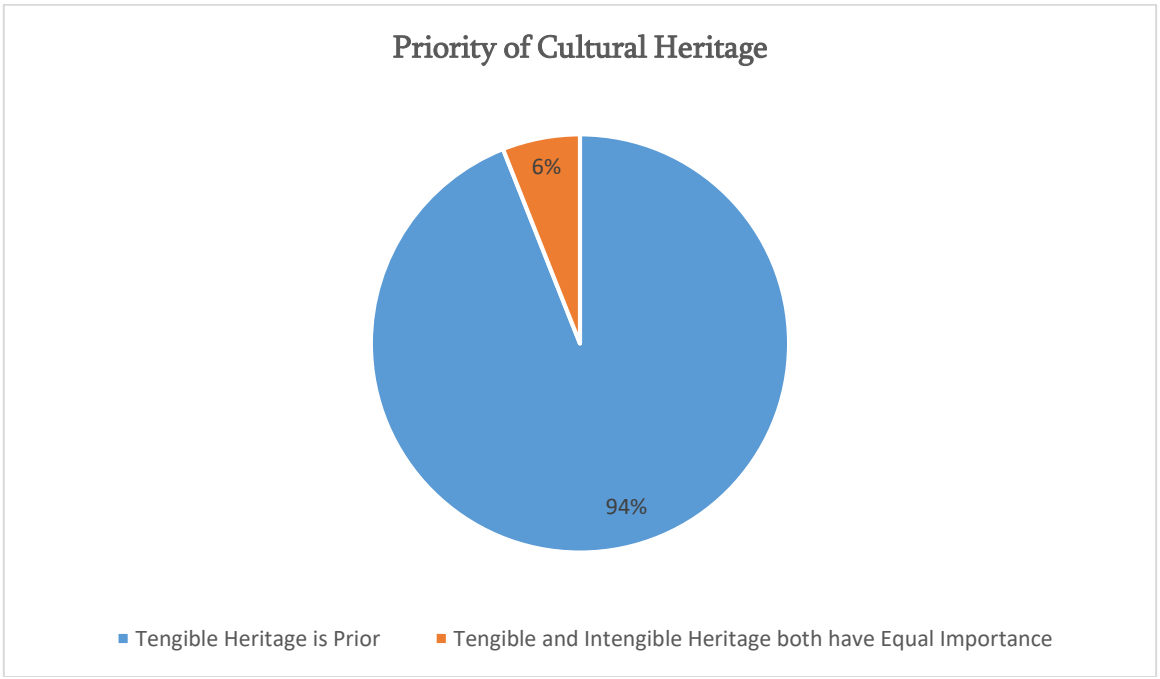
b. Intangible heritage is crafts and folk crafts, gastronomy, traditional festivals, traditional music, oral traditions, religion.

The responses were equally divided 50/50:

It is interesting that in the case of Tbilisi, 64% sided with the UN Tourism definition.



1.2 If all responses to the question - "Which do you consider more important for your tourist programs?" from Tbilisi company representatives were unanimous, and they gave equal importance to both tangible and intangible heritage, there was an exception in Batumi, according to one company representative, tangible heritage is superior.



For more clarity, it must be emphasized that none of the respondents gave priority to intangible cultural heritage.

1.3 To the question, "Do you agree with the statement: 'Probably very few people travel the world to see the Taj Mahal or the Alhambra twice. Cultural tourism

differs from trips aimed at seeing an attraction once and putting a 'plus'. Cultural tourism has much more to do with intangible heritage because it is more flexible than material heritage. The latter can evoke initial charm, but it cannot create a sense of loyalty and deep connection"', the responses from Batumi and Tbilisi respondents were almost equally divided:

Agreed - 44%

Partially agreed - 56%

Disagreed – 0.

1.4 To the question - "Which of the Georgian intangible cultural monuments, included in the UNESCO World Heritage List, are included in your programs?"

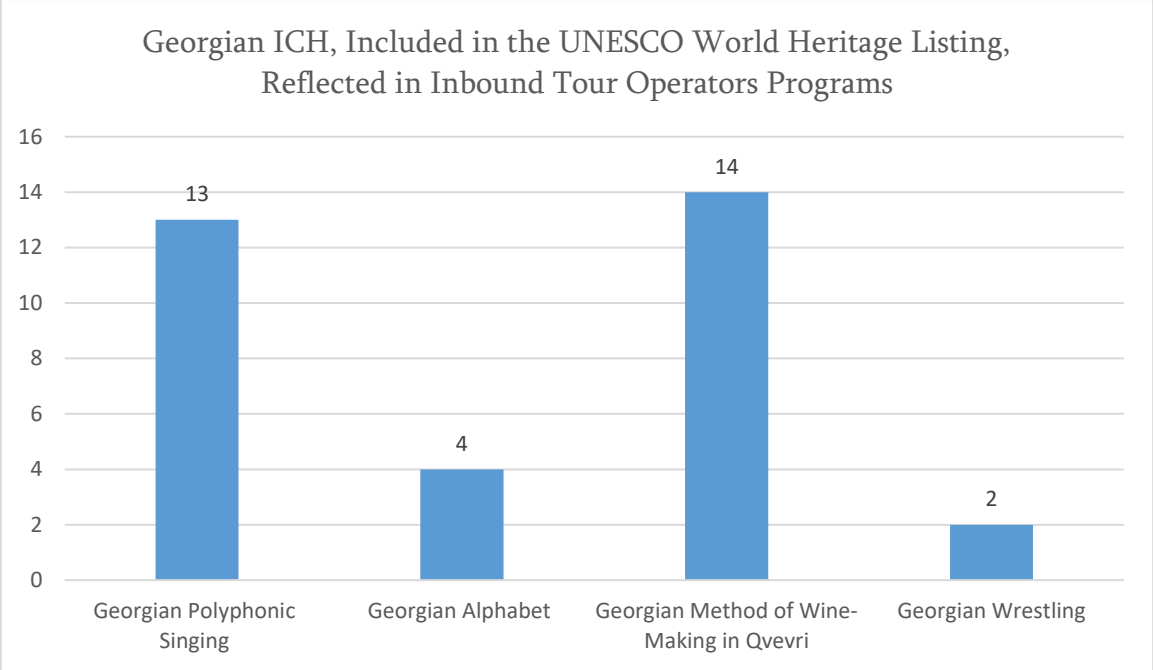
a. Georgian polyphonic singing

b. Georgian alphabet

c. Georgian method of wine-making in Qvevri

d. Georgian wrestling

The responses were distributed as follows:



Note: It was possible to circle several answers to this question.

1.5 To the question "In your opinion, can public centers, museums, archives, and other similar objects play a positive role in raising awareness about intangible cultural heritage?"

a. They can

b. They can but to a small extent

c. They cannot

In this case, almost all respondents from Batumi and Tbilisi noted that public centers, museums, archives, and other similar objects can play a positive role in raising awareness about intangible cultural heritage. There was one exception in Batumi, who circled answer „b"-"They can, but to a small extent".

1.6 To the question - "What role can formal and non-formal education play in raising awareness about the importance of intangible cultural heritage? What kind of educational materials can be developed for this purpose?"

All tour operators, both from Tbilisi and Batumi, confirmed that the proper functioning of the education system can play a positive role in raising awareness about intangible cultural heritage. Different opinions were recorded about the role of formal and non-formal education, but the balance still tipped towards formal education.

1.7 To the question - "In your opinion, can commercial activities related to intangible heritage contribute to raising awareness about the importance of intangible cultural monuments?"

In answering this question, all respondents, both in Batumi and Tbilisi, were unanimous. Everyone believes that commercial activity more or less contributes to raising awareness about the importance of intangible cultural monuments.

1.8 To the question - "In your opinion, what are the hindering factors due to which intangible cultural monuments cannot be adequately used in cultural tourism?"

Unfortunately, a wide range of problems emerged in the answers, although according to tour operator representatives, the primary problem is still the low qualification of service providers and the low quality of service. For example, here are some answers:

- "Scarcity of service providers and high prices for quality products"
- "The main reason why intangible cultural monuments cannot be adequately used is the low quality of service. As a rule, this intangible culture is represented by individuals living in high mountain regions who have little contact with the service sector."
- "Low qualification of those employed in tourism; failure to understand the essence of tourism."
- "Lack of quality tourist product. For example, in the case of festivals - constant change of dates. Also lack of education"
- "Lack of information and offerings about intangible heritage".
- Absence of a guide certification system.

1.9 To the question - "In your opinion, what issues should the relevant state structures focus on to promote the development of cultural tourism, including interest in intangible cultural monuments?"

- There were two main issues in the answers received from Batumi. One, which we wrote about in the case of Tbilisi as well - "More educational programs need to be introduced", and the second problem was not particularly emphasized in the responses received from Tbilisi:
- "Organize folk festivals, concerts, shows, etc."
- "Conduct frequent festivals and events, as well as trainings".

II. **Results of ICH Service Providers Survey**

Providers of tourist services containing intangible cultural heritage were surveyed in Tbilisi and Batumi: museums, Georgian folk dance and song ensembles, Tbilisi sulfur baths, Batumi Boulevard, and other organizations.

2.1 To the first question - "Does your institution's profile allow for the inclusion of ICH elements in the tourist product?", all answers were positive.

2.2 The second question was formulated as follows: "Give some examples of including ICH elements in the tourist product".

Among the examples given, the Adjara Cultural Heritage Protection Agency, Adjara Art Museum, and Tbilisi Giorgi Chitaia Open Air Museum of Ethnography stand out.

Adjara Art Museum has provided five examples:

1. Classical music evenings, once a week, at the same time
2. Ballerina show - the interior allows for this, and foreigners especially like it
3. Painting, ceramics, felting masterclass and sale of works at auction
4. Portrait performance - show of living portraits, opportunity to try on costumes
5. Gen Z - quest-type intellectual game for young visitors.

The public legal entity Batumi Boulevard events include: folklore evenings, masterclasses, dance performances.

Adjara Cultural Heritage Protection Agency events include:

1. Video clip presentation at the Alphabet Tower: This event incorporated Adjara's embroidery traditions (ICH monument since 2019). Embroidery masters were embroidering on-site using various techniques.
2. Organized by the agency, an exhibition of cultural heritage monuments of Adjara and Abkhazia was held at the “Intourist Hotel”. An integral part of the event was Adjarian cuisine, represented by the traditional dish "Borano" (which has ICH status).
3. The agency permanently organizes various events in buildings with cultural monument status, promotes the dissemination of information about monuments. Also, decorative art (embroidery, crafts) or culinary products are always included in the events as props.

Folklore events of the Giorgi Chitaia Tbilisi Ethnographic Museum include:

1. Initiative of the ensemble "Didgori", which earned great public interest and additionally attracted both foreign and Georgian visitors to the museum. The folklore program of the museum was also supplemented by Georgian dance concerts of the ensemble "Potskhishvili". In 2024, "Didgori" and "Potskhishvili" were granted the status of ensemble of the Giorgi Chitaia Ethnographic Museum.
2. Ethnographic theater. Since 2023, historical and ethnographic themed performances and premiere shows are held at various regional houses in the museum.
3. Restoration of the tradition of celebrating Tbilisoba in the museum with the participation of regions. In 2022, the tradition of celebrating Tbilisoba was restored on the museum's territory. At the Tbilisoba festival, all regions of Georgia, including Abkhazia and Samachablo (South Ossetia Administration), presented ethnographic performances and exhibitions, folklore, culinary masterclasses, and wine characteristic of their regions.
4. Traditional Georgian craft masterclasses. In 2022, the craft school was renewed at the Tbilisi Ethnographic Museum. Within the framework of the renewed project, masterclasses are held seasonally, every spring and autumn.
5. Bread baking masterclasses in the tone (traditional Georgian bread oven). In the autumn of 2024, masterclasses for baking Georgian shoti bread in the tone were restored in the museum, in which museum visitors actively participate.
6. Opening of a professional blacksmith school. In November 2023, a professional blacksmith school was opened at the G. Chitaia Tbilisi Ethnographic Museum. The program is led by blacksmith Zakaria Bakuradze. Within the framework of the project, people of different professions, interested in blacksmithing, will study Georgian blacksmithing techniques and acquire blacksmithing as a new profession. The four-month course includes 32 lessons.

The Georgian Folk Song and Instrument Museum of the Art Palace focuses on folk songs, folk dances, and Georgian cuisine.

2.3 Third question –“What ICH elements could be included in the tourist product in the future?”

The following dominate among the answers:

- Folk song;
- Folk dance;
- Georgian cuisine;
- Medicinal sulfur waters and accompanying massage and kisa (traditional bath scrubbing);
- Revival of old Georgian holidays;
- Revitalization of various regional homesteads with costumed ethnographic performances.

2.4 Fourth question –“What problems do service provider organizations face when dealing with ICH issues for tourists?”

The following answers were recorded:

- Lack of interest from tourist agencies;
- Scarcity of budget (this is a concern for budgetary organizations);

- Lack of marketing strategy in terms of ICH;
- Scarcity or absence of human resources;
- Absence of databases of ICH providers;
- Incorrect priorities of tourist agencies when planning tours. Often guides and tourist companies choose locations for tourists from which guides will receive more so-called cashback, i.e., they will get back a percentage of the paid amount and have more income.

2.5 Fifth question-"What measures need to be taken to more actively involve ICH in tourist activities?"

The answers focused on the following issues:

- Organizing info-tours for tour operators and guides;
- Cooperation with tourist organizations;
- More advertising and use of various advertising means;
- Raising awareness;
- Searching for suppliers of elements of ICH and making an agreement with them.

Conclusions

The analysis of the results of our research allows us to formulate several conclusions:

- Regarding intangible cultural heritage, its presentation and interpretation, and current trends in the international market, there is a need to raise their level of awareness which can be supplemented by organizing various business meetings, sharing experiences of foreign experts, and providing free information;
- In many cases, the connection between tour operators and ICH service providers is weak or non-existent. Accordingly, care is needed to establish and strengthen cluster connections;
- In most of the tourist programs of Georgian tour operator companies, two of the four monuments included in the UNESCO Intangible Cultural Heritage List are actively presented (Georgian polyphonic singing and the Georgian method of wine-making in Qvevri), while the other two (Georgian alphabet and Georgian wrestling) are presented only in rare cases. Perhaps more information is needed on what is the reason for this and support to ensure that both the alphabet and wrestling should be more included in tourist programs;
- From the answers of both tour operators and providers, it was unequivocally revealed that more promotion of intangible cultural heritage and raising awareness is needed;
- Raising the level of education and awareness of society and care for increasing the recognition of ICH also emerged as an important issue;
- The research revealed that museums are relatively more interested in ICH products than other types of objects and individuals whose services include ICH elements. Museums try to introduce ICH products to tourists on their own initiative;
- It is important to find, register, and connect ICH element providers with tour operators.

To address the above-mentioned challenges, first of all, it is necessary to interest the Georgian National Tourism Administration and the Ministry of Culture and Sports of Georgia in this direction and take appropriate measures.

The interest and activity of the Ministry of Education, Science and Youth of Georgia, as well as state and private universities, will be important in solving certain problems.

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THE ROLE OF THE OIL SECTOR IN ENSURING SUSTAINABLE DEVELOPMENT OF THE ECONOMY OF AZERBAIJAN

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Abstract
The article reveals the role of the oil sector in the economic development of Azerbaijan. An analysis of the directions of the influence of the oil sector on the sustainable development of the national economy of Azerbaijan is carried out, an assessment is given of the dynamics of investments in the country's economy, the country's GDP, a connection is revealed between the growth of investments and economic growth, etc.

Keywords: oil industry, oil sector, sustainable development, investments, foreign direct investment, domestic investments, gross domestic product, sustainable development, economic growth.

STATEMENT OF THE PROBLEM

The relevance of conducting research related to the issues of the oil sector of the economy in modern economic theory still remains unchanged. The oil industry of Azerbaijan developed rapidly in the 20th century. Powerful production bases and scientific centers were created. One of the greatest achievements of our country was the discovery and development of oil and gas fields. For the first time in world practice, an oil production platform called "Oil Rocks" was developed, which was considered a unique structure at that time. As a result of targeted measures taken during that period, the oil industry was expanded and its ramified infrastructure was created. In recent years, the most important strategic objectives of the country's oil industry have been achieved. The first international oil agreement on the Azeri-Guneshli-Chirag field, concluded in 1994, reflecting the economic sovereignty of Azerbaijan, laid the foundation for the dynamic development of our economy. The work done since that date is a guarantor of the stable development of the present and future generations of the country. In order to successfully fulfill its function, this sector of the economy must be capable of solving multi-purpose tasks of diversified economic development, which is currently one of the priority tasks of the government of the Republic of Azerbaijan.

PURPOSE OF THE ARTICLE

To identify the features of the influence of the oil sector on the sustainable economic development of Azerbaijan in modern conditions and to prepare recommendations for further improvement of this process, taking into account current challenges.

PRESENTATION OF THE MAIN MATERIAL

Ensuring sustainable and long-term development at the current stage of economic development is a priority for every country in the world. Because without the parameters of sustainable development, it is impossible to solve the existing problems in the country's economy at the macro and micro levels. World experience shows that sustainable development reflects the unity of very important elements of economic activity, integration, globalization, etc., without which it is impossible to achieve the ultimate goal of economic development. After gaining independence, the economy of Azerbaijan faced such an important task as transformation into a new economic and political system. Transformation into a new system requires new economic thinking, new economic relations, new economic views and approaches, a new style of economic behavior, a new system of economic relations, etc. Through all this, the country must ensure the transition to a new system of property relations, implement the denationalization of property, continue to develop various forms of ownership, such as state, private, joint-stock, mixed, widely introduce small and medium-sized businesses, ensure the social well-being of the population based on market models. It is necessary to prevent monopoly, eliminate excessive exploitation of resources, expand the use of new technologies in the production process, and radically restructure the economy on the basis of progressive advanced world experience. The implementation of these tasks should have contributed to the creation of a dynamic, stable, sustainable economy in the country and provide the basis, the foundation for sustainable development [1, p. 19].

In the first years of the country's transition to a market economy, that is, in the early 1990s, the volume of gross domestic product of the country was not at the required level, unemployment rose to an unprecedented level, employment fell to an unprecedented record low, inflation reached a hyperlevel. With the exception of the oil complex, industrial production fell to a very low level, and the food market depended on imports by 80-85%. To ensure sustainable development, which became the most important priority of economic policy in the country, it was very important to solve all of the above problems. However, to solve these problems, enormous funds were needed. But these funds were not available either in the state budget or from other sources. At that time, the only hope for the country was only one source - foreign investment, and the only area that could attract investors for foreign investment was the oil and gas sector of the country's economy.

Table 1.

Dynamics of investments in the economy of Azerbaijan for the period from 2000 to 2023 (million manat)

Years	Total investment		Foreign investment			Domestic investment		
	Sum	Increase and decrease (in %)	Sum	Increase and decrease (in %)	Specific weight in total volume (in %)	Sum	Increase and decrease (in %)	Specific weight in totalvolume (in %)
2000	1289,8	-	829,5	-	64,3	460,3	-	35,7
2001	1454,5	112,7	1016,8	122,6	70,0	437,7	95,1	30,0
2002	2718,9	186,9	2172,8	213,7	79,9	546,1	124,8	20,1
2003	4249,3	156,3	3311,0	152,4	77,9	938,3	171,8	22,1
2004	5820,3	136,9	4496,3	135,8	77,2	1324,0	141,1	22,8
2005	6733,4	115,7	4628,5	102,9	68,7	2104,9	158,9	31,3
2006	7415,6	110,1	4514,2	97,5	60,8	2901,4	137,8	39,2
2007	10353,9	139,6	5727,2	126,8	55,3	4626,7	159,5	44,7
2008	13328,0	128,7	5625,8	98,2	42,2	7702,2	166,4	57,8
2009	10475,0	78,6	4395,1	78,2	42,0	6079,9	78,9	58,0
2010	14118,9	134,8	6619,7	150,6	46,8	7499,2	123,3	53,2
2011	17048,8	120,7	6849,8	103,5	40,2	10199,0	136,0	59,8
2012	20251,0	118,8	8102,7	118,3	40,0	12148,3	119,1	60,0
2013	21448,2	105,9	8269,3	102,1	38,5	13178,9	108,5	61,5
2014	21890,6	102,1	9175,6	110,9	41,9	12715,0	96,5	58,1
2015	20057,4	91,6	10998,9	119,8	54,8	9058,5	71,2	45,2
2016	22706,4	113,2	16216,1	147,4	71,4	6490,3	71,6	28,6
2017	24462,5	107,7	15697,3	96,8	64,1	8765,2	135,0	35,9
2018	25877,0	105,8	14002,1	89,2	54,0	11874,9	135,5	46,0
2019	26150,0	101,0	13582,9	97,0	51,9	12568,0	105,8	48,1
2020	22484,0	86,0	10413,2	76,7	46,3	12070,8	96,0	43,7
2021	25313,8	112,6	12751,9	122,5	50,4	12561,9	104,1	49,6
2022	29135,1	115,1	14879,3	142,9	51,1	14225,8	113,2	48,9
2023	32080,9	110,1	14671,2	98,6	45,7	17409,7	122,4	44,3
Всего	386863,3		198945,6		51,4	187887,7		48,6

Source: the table was compiled by the author based on data from the State Statistics Committee of the Republic of Azerbaijan.

In September 1994, three years after Azerbaijan gained independence, as a result of tense and very difficult negotiations that had been conducted since 1991, the "Contract of the Century" was signed in Baku. Thanks to the signing of this agreement and the implementation of the measures envisaged by this agreement, Azerbaijan entered a new stage of economic development. The importance of this stage was that the "Oil Strategy" and the "Open Doors" policy announced by this agreement laid the foundation for attracting large amounts of international capital to the country in the form of direct and portfolio investments. More than 300 companies from more than 10 leading countries of the world began to operate in our country. In order to jointly develop oil fields, foreign companies and countries interested in cooperation with our country began to invest huge amounts of money in the oil and gas complex. Since 1995, thanks to the investments of foreign investors in the economy of our country, a trend of dynamic development has been formed in it, a stable and sustainable situation has been ensured. Thanks to the acceleration of economic processes, since 2000 the foundation of sustainable and long-term development has been laid in the country, an almost annual growth of macroeconomic indicators is observed. The main reasons for this are associated with the activities carried out for the development of the oil complex, the oil sector [6, p.139]. Analyzing the data of the State Statistics Committee of Azerbaijan, we see that both foreign and domestic investments play a great role in ensuring the dynamic development of the country's economy.

Analyzing the structure of investments for the period from 2000 to 2023, we see that in 2000-2007 foreign investments prevailed in terms of specific weight, in 2008-2014 - domestic investments, and in 2015-2023 - foreign investments again (see Table 1).

It should be noted that over all the years of foreign investment, including 2007, 80-85% of these investments were directed to the fixed capital of the oil industry. It is for this reason that the oil and gas sector has developed rapidly and, having created favorable conditions for the development of other sectors of the economy, laid the foundations for sustainable development in the country.

During the analyzed period, all parameters ensuring sustainable development of the country were successfully implemented, including sustainable growth of Gross Domestic Product, employment level, dynamic growth of foreign exchange reserves, reduction of unemployment, inflation targeting in accordance with the goals of economic policy, ensuring a constant positive balance of payments and settlement balances of the

country, making the country a reliable and flexible partner in international relations, creating a normally functioning budget of the country, monetary, monetary and credit, financial, customs, insurance, investment, energy system, etc. [3, p. 106].

As can be seen from the data in Table 1, for the period from 2000 to 2023, investments in the amount of 386863.3 million manats were invested in the country's economy. These funds directly contributed to the growth of the gross domestic product produced in the country in the reporting year, and also created conditions for the dynamic development of all sectors of the economy. 51.4% of these investments, i.e. 198945.6 million manats, accounted for foreign investments, and the remaining 48.6% - domestic investments. As can be seen from the data in Table 1, with the exception of only two years - 2009 and 2015, for the entire period from 2000 to 2023 there was a dynamic growth of total investments in the country's economy. Compared with 2000, in 2010 the total volume of investments increased by 10.9 times and reached 14118.9 million manats. Compared with 2010, the level of this indicator in 2023 increased by 2.27 times and reached 32080.9 million manats. The average annual growth for the analyzed period was 110.1%. This level of growth has become one of the most important factors in the dynamic development of the country's economy [3, p. 96]. As can be seen from the table data, in terms of their share in the total investment volume, foreign investment prevailed in 2000-2007. Thus, the level of this indicator by year was: 64.3% in 2000, 70% in 2001, 79.9% in 2002, 77.9% in 2003, 77.2% in 2004, 68.7% in 2005, 60.8% in 2006 and 55.3% in 2007. Throughout this period, the bulk of foreign investment was directed to fixed capital in the oil sector, which ensured the technical and technological renewal of this sector and ensured its compliance with world standards. The years 2000-2007 are characterized as a period of formation of qualitative parameters of economic development, which allowed the country to create its own foreign exchange reserves. As a result of this, starting from 2008, domestic investments began to prevail in the total volume of investments in the country's economy. Thus, their level in 2008 was 57.8%, in 2009 - 58%, in 2010 - 53.2%, in 2011 - 59.8%, in 2012 - 60%, 2013 - 61.45%, and in 2014 - 58.1%. Already in these years, the formation of the country's own sufficient foreign exchange reserves and the achievement of the necessary level of development of the oil and gas complex led to an increase in domestic investments, and at the same time, their reorientation to other sectors of the economy [6, p. 120].

In order to ensure the dynamic development of the country and the solution of the most important tasks of the economy, with the help of investment policy, the consistent development of strategic sectors of the economy was ensured, a market of competitive investment resources was created, investments were reoriented to priority areas of development, and conditions were created for the favorable development of the private sector.

Table 2.

Dynamics of gross domestic product and investments made in the Republic of Azerbaijan for the period from 2000 to 2023 (million manats)

Years	GDP volume	Change (+:-) in %	Volume of investment	Change (+:-) in %	Share of investments in GDP, in %
2000	4718,1	-	1289,8	-	27,3
2001	5315,6	112,6	1454,5	112,7	27,4
2002	6062,5	114,1	2718,9	186,9	44,8
2003	7146,5	117,9	4249,3	156,3	59,4
2004	8530,2	119,4	5820,3	136,9	68,2
2005	12522,5	146,8	6733,4	115,7	53,7
2006	17746,2	149,7	7415,6	110,1	39,5
2007	28360,5	151,3	10353,9	139,6	36,5
2008	40137,2	141,5	13328,0	128,7	33,2
2009	35601,5	88,7	10457,0	78,6	29,3
2010	42465,0	119,3	14118,9	134,8	33,2
2011	52082,0	122,6	17048,8	120,7	32,7
2012	54743,7	105,1	20251,0	118,8	36,9
2013	58182,0	106,3	21448,2	105,9	36,8
2014	59014,1	101,4	21890,6	102,1	37,1
2015	54380,0	92,0	20057,4	91,6	36,8
2016	60425,2	111,1	22706,4	113,2	37,6
2017	70337,8	116,4	24462,5	107,7	34,8
2018	80092,0	113,8	25877,0	105,8	32,3
2019	81681,0	102,0	26150,0	101,0	32,0
2020	72578,1	88,8	22484,0	86,0	31,0
2021	93203,2	128,4	25313,8	112,6	27,2
2022	133972,7	143,7	29135,1	115,1	21,7
2023	123005,5	91,8	32080,9	110,1	26,1
Всего	1203303,1		386863,3		32,2

Source: the table was compiled by the author based on data from the State Statistics Committee of the Republic of Azerbaijan.

By limiting centralized financing, conditions were created for the implementation of investment opportunities for individual entrepreneurship in the financing of state-owned objects, the implementation of social and infrastructure projects was accelerated, the investment cycle was shortened as much as possible, etc. [3, p. 36].

One of the most important indicators characterizing the provision of dynamic, sustainable development of the country is the dynamics of the gross domestic product (see Table 2).

As can be seen from the data in Table 2, during the analyzed period, i.e. from 2000 to 2023, with the exception of 2009 and 2015, throughout all other years, the country experienced GDP growth dynamics. Compared with the same indicator in 2000, in 2023 this indicator increased by 26.1 times.

As a result of ensuring dynamic development, from 2000 to the end of 2008, GDP increased by 8.5 times and amounted to 40137.2 million manats. As a result of the financial crisis that engulfed the global financial system in 2009, the GDP in our country decreased by 4535.7 million manats or 11.3% compared to 2008 and amounted to 35601.5 million manats. However, in subsequent years, the analyzed indicator again showed growing dynamics, increasing by 2014 and amounting to 59014.1 million manats. This is 1.6 times more than the 2009 figure.

As can be seen from the table data, as a result of the global crisis of 2015, due to a fourfold drop in oil prices, the GDP this year amounted to 54380.0 million manats, which compared to 2014 means a decrease of 4634.1 million manats or 8%.

In subsequent years, as a result of the growth dynamics by the end of 2023, the GDP volume increased by 2.26 times compared to 2015. The GDP growth for the analyzed period shows that the country is undergoing a process of sustainable development. Despite the fact that in recent years there has been a sharp drop in world oil prices on the world market, as a result of large-scale diversification in the country, the GDP volume not only did not decrease, but remained stable and increased from year to year [4, pp. 11-13].

Analyzing the GDP growth rate, we see that before 2007, the level of this indicator grew faster. Thus, compared to 2000, its growth this year was 601%. In other periods, such growth was not observed. The main reason for this was the rapid development of the oil sector due to the strong influx of foreign capital into the country's economy at that time, and the boom in economic development observed on this basis.

Analyzing the indicators of Table 2 and taking into account that over 90% of investment, which is the most important factor in the development of the country's economy, is directed to the oil sector, we can say that the oil sector has acted as a key source of sustainable and long-term development. We see that over the years, investments have played a decisive role in the formation of GDP. In 2003 and 2004, the share of investments in GDP was 59.45% and 68.23%, respectively. These are the highest indicators for 2000-2023. In general, the analyzed indicator for this period was formed at the level of 35.59%, which is quite a high indicator. As a result of ensuring sustainable and long-term development, political, economic, energy, environmental, currency problems and national security issues of the country have been resolved. Having strengthened its geopolitical and geo-economic positions, our country has become the most reliable participant in global processes and a competitive partner in economic relations with each country.

CONCLUSIONS

After the Republic of Azerbaijan gained independence, ensuring dynamic, sustainable development of the economy became possible as a result of the implementation of multifaceted, deep economic processes in various directions. In general, the country's economy's exit from the crisis, the creation of economic stability, the achievement of a stable, sustainable situation, the creation of a basis, a foundation for sustainable development were realized due to the oil sector. The country's oil sector played a decisive role not only in solving these problems, but also in strengthening the geo-economic and geopolitical position of the country. The development of this sector and the stabilization of the macroeconomic situation in the country due to this direction made it possible to implement sustainable development in the country. Since the oil sector is still the leading sector in the country, the most important problems are solved at both the macro and micro levels with its help and support. At the same time, the country is pursuing a policy of large-scale diversification due to this sector, which ultimately ensures the acceleration of sustainable development.

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JURISPRUDENCE

ENCOURAGING BICYCLE MOVEMENT IN GEORGIA BASED ON THE EXAMPLE OF EUROPEAN COUNTRIES

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Abstract

In various countries around the modern world, transportation is one of the primary sources of greenhouse gas emissions. This sector negatively impacts the quality of life in urban areas, as it pollutes the air, causes unwanted noise, and exerts harmful effects on soil layers. Ultimately, this leads to land degradation, making it unusable for agricultural and other activities.

Excessive traffic, congestion, and road accidents are directly linked to human health, posing a significant threat to the normal existence of humanity. In many countries, this situation causes public dissatisfaction, which is often expressed through various forms of protest. In major cities and global metropolises, there is a continuous, dynamic process of modernizing the transportation sector based on rapid, planned, and contemporary technologies, while also incorporating global approaches and innovations. A key component of ongoing urban planning projects is the implementation of large-scale, diverse infrastructure mobility, including the strategy for accommodating bicycle traffic and establishing cycling facilities. Bicycle use and the development of cycling systems occupy an essential place among the core components of city master plans.

The resolution of these issues is directly related to governance structures that establish the necessary conditions for infrastructure development and the complete arrangement of safe bicycle lanes.

Using Georgia as an example, it can be noted that for the first time in the Caucasus, and even on an Asian scale, the "Bicycle Policy Audit" (BYPAD) methodology was applied in the development of Batumi's general plan. As for the situation in Tbilisi, it can be said that in terms of bicycle infrastructure development, bike lanes were established for the first time in the city's history in recent years, which should be considered one of the successful outcomes of the transportation reform. In the case of Georgia, it can be noted that the city of Batumi, during the development of its master plan, became the first in the Caucasus and across Asia to apply the methodology of the "Bicycle Policy Audit" (BYPAD). As for the situation in Tbilisi, in recent years, for the first time in the city’s history, bicycle lanes have been established, which should be considered one of the successful outcomes of transportation reform.

Using qualitative research methods, this article examines the ways leading European countries promote bicycle use, including the implementation of state policies, the provision of appropriate legislative frameworks, the development of cycling infrastructure, and safety measures, as well as public awareness campaigns. The study analyzes the current situation in Georgia, ongoing legislative and educational initiatives, and infrastructure projects, identifying future activities planned to encourage cycling in the country.

Keywords: Bicycle, bicycle lane, cycling infrastructure, cycling sector, traffic, quality of life, air pollution.

Introduction

The subject of this research is a highly popular and relevant issue in the modern world, both by its nature and significance, as well as due to its increasing prioritization. A historical overview of sources allows us to discuss the foundational reasons behind the emergence of the bicycle lane system, which is tied to the invention of the bicycle.

"In 1790, the first bicycle, invented in France, resembled a two-wheeled wooden horse without pedals or a steering mechanism. In 1817, in Germany, a guiding mechanism for movement was added. By 1861, pedals appeared on bicycles in France. In 1870, the first large-front-wheeled bicycle was created in Britain. Finally, in 1903, the first cycling race, the Tour de France, was held."

The word "bicycle" originates from the French word "vélocipède," which means "fast foot." It refers to a two-wheeled mechanical vehicle (though there are also one-, three-, and four-wheeled modifications). It is operated by pedaling, and speed is regulated through the use of these pedals.

In the routine rhythm of society's daily life, the bicycle has held a significant place for centuries due to its functional utility. For instance:

In London and Tallinn, emergency medical personnel use bicycles for transportation;

During the Anglo-Boer War (1899-1902), both sides (Great Britain and the South African Republics) successfully used bicycles for reconnaissance and communication;

During World War I, bicycles were used for reconnaissance, communication, and transporting the wounded;

In 1937, Japan actively used bicycles during its invasion of China, and again in 1941 during its invasion of Singapore;

In the Wehrmacht, all reconnaissance battalions of infantry divisions included cyclist units;

During World War II, folding bicycles were part of the equipment used in Allied operations, particularly by paratroopers;

During the Vietnam War, guerrilla fighters used bicycles for transporting goods;

Cyclist units existed in the armed forces of Sweden and Switzerland until the early 2000s;

In Great Britain, Germany, Hungary, and in the postal services of many countries, bicycles remain an irreplaceable means of transportation.

Despite the boom in automobile transportation in various European countries, the bicycle has retained its special significance, leading to the development of cycling infrastructure to meet existing needs. The networks of bicycle lanes created as part of transportation reforms are noteworthy. Active efforts are underway to develop and implement safety regulations and standards for cycling lanes. Additionally, research is being conducted to assess the impact of bicycle lanes in reducing transport-related pollution, with the aim of creating a sustainable and viable environment.

During the existence of the Soviet Union, cycling as a form of road transport was not developed in the cities of Georgia, which was part of this totalitarian state.

It is worth noting that in many highly developed European countries, such as the Netherlands, Denmark, Germany, and France, the bicycle has long been and continues to be one of the most popular means of transportation for the population. Furthermore, these countries continuously update their efforts to further popularize cycling as a mode of transport.

Netherlands

Cycling became popular in the Netherlands at the beginning of the 1900s. The favorable landscape and compact cities made bicycles an ideal mode of transportation. Before World War II, cities in the Netherlands were known for their large number of cyclists, and the bicycle was the primary means of transportation. However, after World War II, as in many other Western countries, the use of automobiles increased in the Netherlands, and urban planning increasingly favored cars, leading to a decline in bicycle use. By the 1970s, the growing number of cars caused a sharp increase in traffic accidents, many of which involved cyclists. This provoked public outrage, and in response to the high number of child deaths in road accidents, the movement "Stop de Kindermoord" ("Stop the Child Murder") emerged, calling for safer streets and better cycling infrastructure in the country (Fact sheet Cycling infrastructure, 2024). The 1973 oil crisis highlighted the vulnerability of a car-dependent society and sparked interest in alternative transportation methods, including cycling (Decisio, 2016). In response to public pressure and the oil crisis, the Dutch government began investing in the development of cycling infrastructure, and policies promoting cycling and public transportation became a priority over private transport.

Cities started building extensive networks of segregated bike lanes, making cycling safer and more attractive. Amsterdam and other large cities became models of urban cycling infrastructure (Fiets van de zaak, 2020). In the Netherlands, urban planning integrates bicycles into the broader transport system, with dedicated bike lanes, parking facilities, and traffic signals specifically designed for cyclists.

Over the decades, cycling has become part of Dutch culture. It is included in school curriculums, and various campaigns promote the health, environmental, and social benefits of cycling. The country continues to invest in cycling infrastructure, maintaining bike lanes and expanding parking facilities. Innovations such as smart traffic lights that prioritize cyclists and the development of "bicycle highways" (long-distance, high-capacity bike routes) reflect the Netherlands' ongoing commitment to cycling. Overall, the approach to cycling infrastructure and policy in the Netherlands has created one of the most cyclist-friendly environments in the world, promoting bicycles as a sustainable and safe mode of transport and serving as a model for other countries.

In the Netherlands, bicycle purchases are often subsidized through various programs and incentives aimed at promoting bicycles as a sustainable and safe means of transport. For example, the tax-free bicycle scheme, known as the Dutch "fiets van de zaak" scheme, allows employers to provide bicycles free of charge to employees, who can use them for commuting and personal use. This scheme often includes electric bicycles and even high-end models. Many employers offer bicycle leasing programs, where employees can rent bicycles at discounted rates through salary deductions, making high-quality bicycles more accessible (Fiets van de zaak, 2020).

At the same time, government subsidies and incentives, along with local government initiatives, play a crucial role. Some municipalities offer subsidies or grants for purchasing bicycles, particularly electric bikes, to encourage residents to switch from cars to bicycles. These programs vary by region and often aim to reduce traffic congestion and improve air quality. Certain subsidies may be available for specific groups, such as students, low-income families, or the elderly, making bicycles more affordable. Some schemes provide discounts on new bicycles when trading in old ones to purchase a newer model (Fact sheet Cycling infrastructure, 2024).

Together, these initiatives create a supportive environment for cycling, making it an attractive and financially viable option for residents of the country.

Denmark

The development of appropriate infrastructure for cyclists in Denmark began at the dawn of the 20th century. The bicycle gained popularity, leading to the creation of the first dedicated bike lanes in the capital city of Copenhagen in the 1910s and 1920s. The growth in the number of cyclists prompted city planners to start designing bicycle infrastructure. Copenhagen’s first dedicated bike lane was opened in 1934. Despite a shift toward a more car-oriented society in the mid-20th century, the bicycle remained a popular mode of transportation, and improvements to cycling infrastructure continued (The Rise of Cycling in Denmark, 2024).

In Denmark, particularly in Copenhagen, the growth of cycling is supported by a combination of infrastructural, political, and cultural factors:

Extensive Cycling Infrastructure and Investment – The country invests significantly in the development of

high-quality cycling infrastructure. Denmark boasts a vast network of dedicated bike lanes, with Copenhagen alone having over 390 kilometers of bike lanes, many of which are segregated from car traffic. These include bridges and tunnels specifically for cyclists (City of Copenhagen, 2023).

Safety Measures – Bike lanes are designed with the safety of cyclists in mind. This includes specific traffic lights for cyclists, safe crossing points, well-designed intersections, and separate bike lanes to enhance safety and encourage more people to cycle (Andersen, 2021).

Cycling-Friendly Policies – The government prioritizes cycling as a mode of transport, giving cyclists the right of way in many situations, making cycling a preferred option on the roads (Cycling in Denmark: A Model for Sustainable Urban Mobility, 2024).

Bicycle Parking and Urban Planning – Denmark has numerous bicycle parking facilities, including large racks and secure parking areas at public venues. Urban planning also incorporates cycling into the city's design, ensuring that bicycles are the most convenient and efficient form of transportation for daily commutes (City of Copenhagen, 2023).

Public Awareness and Culture – Cycling is deeply ingrained in Danish culture. Many people choose to cycle daily, whether for leisure or commuting to work (Cycling in Denmark: A Model for Sustainable Urban Mobility, 2024).

Education and Campaigns – The government and various organizations run regular educational campaigns to raise public awareness, encouraging cycling and teaching citizens about its benefits. Schools often include cycling education in their curriculum, emphasizing health, environmental, and financial advantages (Andersen, 2021).

Economic Incentives – Financial incentives and subsidies are available for purchasing bicycles, especially electric bikes. There are also tax benefits for companies that promote cycling among employees (City of Copenhagen, 2023).

Integration with Public Transport – There is seamless integration between cycling and public transport, with bicycle parking facilities at train and bus stations and the ability to bring bicycles onto trains (Cycling in Denmark: A Model for Sustainable Urban Mobility, 2024).

Cycling Events and Initiatives – Denmark organizes and supports various cycling events, such as "Bike to Work Day." During rush hour, cycling is often faster and more convenient than driving (Andersen, 2021).

Support for Innovation – Denmark encourages and supports technological and service innovations related to cycling, such as bike-sharing programs and mobile apps for cyclists (City of Copenhagen, 2023).

The Danish government actively promotes interest in cycling, and these combined measures create an environment where cycling is convenient, safe, and popular.

Federal Republic of Germany

The popularity of bicycles in Germany began to rise in the late 1800s. Early cycling clubs and volunteer groups formed, promoting the bicycle as a recreational and transportation tool. In the 1920s and 1930s, Germany developed plans for building bicycle lanes, primarily in cities. Like many other countries, Germany saw an increase in motor vehicle use after World War II, which led to a decline in bicycle infrastructure and usage (Bicycle Planning and Policy in Germany, 2023). In the 1960s and 1970s, urban planning heavily favored cars, often at the expense of cyclists and pedestrians. The oil crisis of the 1970s highlighted the need for alternative modes of transportation, sparking renewed interest in the bicycle as an economical and environmentally friendly way to travel. Growing environmental awareness and public health campaigns in the 1980s and 1990s supported sustainable urban mobility, including cycling (Cycling in Germany: History and Future, 2022). By the end of the 20th century, both federal and local governments began investing in cycling infrastructure. Policies and funding were directed towards building and improving bicycle lanes and related facilities. Many cities and regions developed comprehensive cycling plans. For example, cities like Berlin, Hamburg, and Munich expanded their networks of bicycle lanes and bike-friendly streets (Fahrradinfrastruktur in Deutschland, 2020). Various campaigns and programs promote cycling, including initiatives that encourage commuting by bicycle and public awareness campaigns about the benefits of cycling.

In recent years, Germany has seen a sharp increase in people choosing to cycle, driven by factors such as awareness of climate change and the rise of electric bicycles. Continued investments in cycling infrastructure have followed. Examples include the construction of "Radschnellwege" (bicycle highways) to promote long-distance cycling, as well as the development of bike-sharing programs in many cities (Cycling in Germany: History and Future, 2022). Measures have also been taken to integrate bicycles into the public transport system, including providing bike parking at train stations and allowing bicycles on public transit. Improvements in road safety measures for cyclists, such as better lighting, road signs, and traffic-calming devices, have also been implemented.

At the same time, cycling has become an integral part of urban culture in many German cities. It is seen as a practical and efficient mode of transportation for commuting, shopping, and recreation. Schools and community programs often include training on safe cycling for children and adolescents.

Notably, the COVID-19 pandemic led to a significant increase in cycling in Germany, as people sought socially distanced modes of transport. Temporary bike lanes were introduced in many cities, with some becoming permanent due to their popularity (Cycling in Germany: History and Future, 2022).

Overall, Germany's approach to the development of cycling is characterized by growing recognition of the bicycle's benefits for urban mobility, health, and the environment. The country continues to invest in and promote cycling as a key component of sustainable transportation.

France

Cycling gained popularity in France in the late 1800s, becoming fashionable both as a recreational activity and a means of transportation. Cycling clubs and events, such as the "Tour de France" (founded in 1903), helped to popularize the cycling culture. France followed a similar path to other European countries in developing cycling infrastructure and promoting cycling as a means of transport (Papon, 2021). Under the leadership of Paris Mayor Anne Hidalgo, Paris has become a model for urban cycling. The city has significantly expanded its cycling infrastructure, including protected bike lanes, bike-sharing applications (like "Vélib"), and car-free zones. The introduction of the "Vélib" bike-sharing app in 2007 was a major step forward in promoting cycling. This system has since been expanded to other cities in France (Vélib' Bike-Sharing Program, 2023).

Additionally, some regions have developed "voies vertes" (greenways) and "véloroutes" (cycling routes) to promote long-distance cycling, connecting rural areas and villages (Papon, 2021). Cycling is increasingly popular for commuting, leisure, and tourism. The French government supports cycling through campaigns and events like "Semaine du vélo" (Bike Week), and schools and community programs often include training for children and adolescents on safe cycling (La Semaine du vélo: Promouvoir le cyclisme pour tous, 2022).

France continues to invest in cycling infrastructure, with plans for further expansion of bike lanes and integration with public transport. The French government has set ambitious goals to promote cycling, including subsidies for purchasing bicycles (particularly e-bikes), tax benefits for cyclists, and significant funding for cycling projects. Paris, in particular, has launched several phases of the "Plan Vélo," aiming to become 100% bike-friendly by 2026, with extensive cycling networks and infrastructure improvements. Overall, France's approach to cycling development reflects a growing recognition of the benefits of cycling for urban development, health, and the environment (Making Paris Bike-Friendly by 2026, 2023).

Georgia

Following the restoration of state independence, Georgian legislation, particularly the law initially passed by the Parliament of Georgia on May 28, 1999, titled "On Road Traffic Safety" (Law of Georgia, www.matsne.gov.ge, 1999), and currently the "Law on Road Traffic," which came into effect on March 1, 2014, established the legal foundations for organizing road traffic and ensuring traffic safety in Georgia. This law outlines the primary directions of state policy in road traffic safety, the responsibilities of state authorities, traffic rules and conditions, road signs, markings, and the rights and obligations of road users, among other aspects (Law of Georgia, www.matsne.gov.ge, 2013).

At the legislative level, terms such as bicycle, bicycle path (bike lane), and bicycle lane have been defined. Specifically, according to the aforementioned law:

A bicycle is a vehicle with at least two wheels that is powered solely by the muscular energy of the person riding it, specifically through pedals or handles. This term does not include wheelchairs. Electric bicycles are also equated to bicycles.

A bicycle path (bike lane) is a road or part of a road designated for bicycle movement, marked with the appropriate road signs, and separated from other parts of the road or its other elements by design.

A bicycle lane is a lane on the roadway designated for bicycle traffic. This lane is separated from the rest of the roadway by longitudinal road markings (Law of Georgia, www.matsne.gov.ge, 2013).

Furthermore, the term "road" in the law can encompass bicycle lanes. Additionally, this legislative act established the basic principles and specific rules for cycling on bike lanes or bicycle lanes by road users, laying the groundwork for the promotion and future development of cycling in Georgia.

The annex (Annex №1 on Road Signs) of the law defines the following:

Warning road sign 1.25: "Bicycle Lane Crossing" – this sign warns drivers about approaching a crossing point for a bicycle lane marked by sign 4.4.

These legislative measures aim to promote cycling in Georgia by providing a legal framework for its development and integration into the country's traffic system.

1.25

ველობილიკის

გადაკვეთა

Prohibitory road sign 3.9: "Bicycle Traffic Prohibited" – This sign prohibits the movement of bicycles and mopeds in the designated area.

3.9

ველოსიპედით

მოძრაობა აკრძალულია

Directional road sign 4.4: "Bicycle Path" – This sign indicates a path specifically designated for bicycle traffic, which is structurally separated from other parts

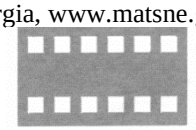
of the road or its elements. The 4.4 sign is placed primarily at the start of the bicycle path and is repeated after each road crossing.

4.4

ველობილიკი

The law's Annex №2 (Road Markings) established horizontal marking 1.15, which indicates the location where a bicycle lane intersects with the roadway. This marking helps both cyclists and other road users to identify the crossing point, improving safety and road navigation.

This provision ensures better organization of traffic, making the roads safer and more efficient for all users. (Law of Georgia, www.matsne.gov.ge, 2013)



1.15

In accordance with the aforementioned legislative amendment, changes were made to Article 125 of the Administrative Offenses Code of Georgia, adding part 13, which states that the movement, stopping, or parking of any vehicle other than a bicycle (with exceptions permitted by Georgian law) on a bicycle path or bicycle lane will result in a fine of 100 GEL. Additionally, according to note 11 of the same article, in cases where the offense specified in part 13 is committed, the parked or stopped vehicle may be immediately towed to a special secured parking lot. The vehicle will be returned to its owner/holder upon the presentation of documents proving payment of the towing and storage fees, the vehicle's registration certificate or power of attorney, a document proving the right to use the vehicle as per Georgian law, and an identity document.

The representative body of the municipality is authorized to determine the fees for towing and storing vehicles in a special secured parking lot in cases of administrative offenses under the municipality's jurisdiction. (Law of Georgia, www.matsne.gov.ge, 2019).

Based on the above changes in the Administrative Offenses Code of Georgia, a change was made to the decision of the Tbilisi Municipal Assembly from December 27, 2016, №33-99, titled "On Approving the Rules for Regulating Parking of Vehicles within the Administrative Boundaries of the City of Tbilisi and on Determining the Fees for Towing and Storing Vehicles in a Special Secured Parking Lot, and for Wheel Clamping." This decision established the fees for towing and storing vehicles in a special secured parking lot in cases of administrative offenses (Tbilisi Municipal Assembly Decision, 2016).

Comprehensive research conducted in 2023 revealed the following transportation patterns within the administrative boundaries of Georgia's capital: 39.1% of people use public transport (including 16.4% using M2 category buses (minibuses), 15.3% using M3 category buses (large and medium-capacity buses), and 7.4% using underground electric transport (metro)); 27.7% use private cars; 26.9% are pedestrians; 2.8% use "A" category light vehicles (taxis, M1 category); 1.3% use other means of transport; and only 0.1%-0.1% use bicycles or two-wheeled electric scooters (Tbilisi Transport Plan 2023-2043).

In recent years, approximately 35 kilometers of bicycle lanes have been constructed in Tbilisi, marking a significant beginning in the process of creating a network of bike lanes. Every year, more and more cyclists appear on the streets of Tbilisi, although the network is still not extensive enough to provide a truly safe environment for cycling throughout the city (Tbilisi Transport Plan 2023-2043).

Other Issues Related to Cycling

Several challenges hinder the growth and safety of cycling in Tbilisi:

Limited Bicycle Routes: There are very few routes with dedicated bicycle lanes.Lack of Connectivity: Bicycle routes are not interconnected, restricting the distances and areas where cyclists can safely travel.Inadequate Bicycle Infrastructure: Bicycle infrastructure, particularly at intersections, is not always well-protected, visible, or clearly marked, creating potential conflicts between different road users. High Speed Limits: The high speed limits for vehicles and lack of speed control in local streets create hazardous conditions for cyclists. Limited Bicycle Parking: There is a shortage of bicycle parking facilities, except for a few bike stations along main corridors and in commercial areas. Considering these challenges, the Tbilisi City Hall developed the 2023-2043 Long-Term Transport Plan – Sustainable Urban Mobility Strategy, which aims to prioritize accessibility, sustainability, and inclusivity, all of which are vital for creating a vibrant urban environment. The plan envisions that by 2043, the modal share of transportation in the city will be characterized as follows: 43% of the population will use public transportation (M2 category buses (minibuses), M3 category buses (large and medium-capacity buses), and underground electric transport (metro)); 27% will be pedestrians; 20% will use private cars; 8% will cycle; and 2% will use "A" category light vehicles (taxis, M1 category).

When comparing the 2043 projections with the 2023 data, it becomes evident that a sharp increase in cycling is expected. To achieve this, the action plan includes legislative and institutional changes, improvements to urban living quality, parking management, and road safety. To make cycling safer, more attractive, and reliable, the plan includes a wide range of programs aimed at creating safe cycling infrastructure and raising awareness about cycling. It also focuses on expanding the availability of shared bicycles, with a particular focus on increasing the number of bicycle routes within the capital's administrative boundaries. In the long

term, the bicycle network is projected to expand to a total of 325 kilometers (Tbilisi Transport Plan 2023-2043).

The 20-year strategy also includes a 5-year Action Plan for 2024-2028, which, among other large-scale projects, involves redesigning four of the eleven bridges over the Mtkvari River in Tbilisi — Metekhi Bridge, Saarbrucken/Dry Bridge, Galaktion Bridge, and Baratashvili Bridge (which are mainly used for automobile traffic) — to make them safer and more attractive for pedestrians and cyclists. Tbilisi's weather is ideal for cycling most of the year, but given that the city is large and the current 35 kilometers of bike lanes cover only a small portion of it, the network is insufficient for ensuring a truly safe cycling environment. Moreover, these lanes are not always continuous and do not form a connected network. Cycling on streets without bike lanes can be extremely dangerous.

Thus, the focus is on completing Tbilisi's cycling network with a dual strategy: creating connected, safe, and attractive bicycle routes. With the assistance of the German Development Agency (GIZ), an additional 30 kilometers of bike routes will be added, and in the long term, the network will reach 325 kilometers. In the short term, high-quality bike lanes will be constructed along major transport corridors, the riverbanks, and across the Vake and Saburtalo districts. By 2022, 20 kilometers of bike routes had already been built in Tbilisi, and the goal is to create fully segregated bike lanes separated from motor traffic for safety and comfort. In the short term, buffer bike lanes will be constructed, and in the future, for optimal safety, bike lanes will be elevated to sidewalk level using concrete.

Along with the general bike network, Tbilisi also plans to create "bike-friendly districts" or "Velo-Districts". These are areas where independent cycling networks allow safe travel to any part of the district. A pilot Velo-District will be implemented in the Marjanishvili district, with a second possible Velo-District planned for Saburtalo. Both strategies will include additional infrastructure such as high-quality lighting, road signs for navigation, dedicated traffic lights giving priority to cyclists, and new crossings over rivers and railways. Additionally, bike parking will be installed along the network, near major bus and metro stations, and bicycle repair service centers will be established.

It is important to note that the general network and Velo-Districts are only the first steps toward a broader city-wide cycling network. The long-term vision for Tbilisi is to design all urban streets to be safe for cyclists. Thus, cyclist safety will be considered in the redesign of every street.

Conclusion

The analysis presented in this paper leads to the conclusion that the implementation and development of a comprehensive bicycle lane system is essential when designing transport infrastructure. Bicycle lanes provide a safe means of transportation and are also ecologically significant, directly impacting public health. It is generally recommended that bicycle lanes be constructed along high-speed and inner-city roads, and they must be physically separated from both motor vehicle traffic and pedestrian pathways.

In major cities of developed countries with advanced economies, modern mobile cycling infrastructures have been created, utilizing contemporary technologies. These systems enable residents to use bicycles year-round. In the context of public health and environmental protection, as well as in various specialized fields, research is conducted on the development of the cycling sector, both in academic and professional circles. These studies and their qualified recommendations further demonstrate the priority and necessity of the subject. Research indicates that air pollution in Georgia is primarily caused by vehicle emissions, which negatively affect both human health and the environment.

To improve this situation, Georgia’s legislative and executive bodies have been actively implementing various measures, both by adopting legislative and regulatory acts and ensuring their enforcement. Examples include the Law on Road Traffic, amendments to the Administrative Code, regulatory documents passed by municipal councils, and their enforcement as outlined in this paper. These efforts demonstrate the country’s commitment to improving transportation safety and infrastructure.

Public awareness regarding cycling and related infrastructure must be raised to foster a positive attitude towards this system. International organizations have also taken special approaches to this research topic. Regular meetings are held under the auspices of the United Nations and the WHO's Pan-European Programme on Transport, Health, and Environment, where various positions are expressed. However, rational decisions are ultimately made, with a consensus that "to promote walking and cycling in cities, municipalities should improve pedestrian and cycling infrastructure and raise public awareness about a healthy lifestyle."

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MATHEMATICAL SCIENCES

DERIVATION OF A NUMERICAL SCHEME FOR FIFTH ORDER INITIAL VALUE PROBLEMS USING MAXIMA

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Abstract
In this paper, we present a derivation of a numerical scheme to solve fifth order initial value problems using the open source computer algebra system MAXIMA.

Keywords: Initial Value Problems, Taylor series, Maximum Absolute Error, Approximation, Lipschitz condition, computer algebra system, MAXIMA.

1. Introduction

An efficient method for solving fifth order initial value problems was proposed by the author with Dinesh Kumar [3] and for third and fourth order initial value problems by the same in [1, 2].

In this paper, we present the MAXIMA code to derive the schemes used in the papers [1, 2, 3]. Here we present the code only for the fifth order IVPs and the schemes in [1, 2] was also derived in the same manner with some minor modifications.

2. The Derivation of the Scheme using MAXIMA

Recall the scheme presented in the paper[3] :
Choose and fix a real number a :
$a \neq -1$.
We define the scheme :

$$\overline{u_{i+1}} = u_i + hu_i' + \frac{h^2}{2}u_i'' + \frac{h^3}{6}u_i''' + \frac{h^4}{24}u_i^{IV} + c_1h^5u_i^V + c_2h^6u_i^{VI}$$
$$\overline{u_{i+1}'} = u_i' + hu_i'' + \frac{h^2}{2}u_i''' + \frac{h^3}{6}u_i^{IV} + \frac{h^4}{24}u_i^V + c_1h^5u_i^{VI}$$
$$\overline{u_{i+1}''} = u_i'' + hu_i''' + \frac{h^2}{2}u_i^{IV} + \frac{h^3}{6}u_i^V + c_1h^4u_i^{VI}$$
$$\overline{u_{i+1}'''} = u_i''' + hu_i^{IV} + \frac{h^2}{2}u_i^V + c_1h^3u_i^{VI}$$
$$\overline{u_{i+1}^{IV}} = u_i^{IV} + hu_i^V + c_1h^2u_i^{VI} \tag{2.1}$$

We find $a_0, b_0, c_0, d_0,\ e_0, c_1, c_2$ so that

$$u_{i+1} = a_0(\overline{u_{i+1}} + au_i) + b_0h(\overline{u_{i+1}'} + au_i') + c_0h^2(\overline{u_{i+1}''} + au_i'') + d_0h^3(\overline{u_{i+1}'''} + au_i''') + e_0h^4(\overline{u_{i+1}^{IV}} + au_i^{IV}) \tag{2.2}$$

Using Taylor series on the left hand side

$$u_{i+1} = u_i + hu_i' + \frac{h^2}{2}u_i'' + \frac{h^3}{3!}u_i''' + \frac{h^4}{4!}u_i^{IV} + \frac{h^5}{5!}u_i^V + \frac{h^6}{6!}u_i^{VI} + O(h^7)$$
$$= a_0\left(u_i + hu_i' + \frac{h^2}{2}u_i'' + \frac{h^3}{6}u_i''' + \frac{h^4}{24}u_i''' + c_1h^5u_i^V + c_2h^6u_i^{VI} + au_i\right)$$
$$+b_0h\left(u_i' + hu_i'' + \frac{h^2}{2}u_i''' + \frac{h^3}{6}u_i^{IV} + \frac{h^4}{24}u_i^V + c_1h^5u_i^{VI} + au_i'\right)$$
$$+c_0h^2\left(u_i'' + hu_i''' + \frac{h^2}{2}u_i^{IV} + \frac{h^3}{6}u_i^V + c_1h^4u_i^{VI} + au_i''\right)$$
$$+d_0h^3\left(u_i''' + hu_i^{IV} + \frac{h^2}{2}u_i^V + c_1h^3u_i^{VI} + au_i'''\right)$$
$$+e_0h^4(u_i^{IV} + hu_i^V + c_1h^2u_i^{VI} + au_i^{IV}) \tag{2.3}$$

Truncating the series and equating the corresponding coefficients of

$$u_i, hu_i', h^2u_i'',\ h^3u_i''', h^4u_i^{IV},\ h^5u_i^V,\ h^6u_i^{VI}$$

on both the sides, we get

$$\begin{aligned} aa_0 + a_0 &= 1 \\ ab_0 + b_0 + a_0 &= 1 \\ ac_0 + c_0 + b_0 + \frac{a_0}{2} &= \frac{1}{2} \\ ad_0 + d_0 + c_0 + \frac{b_0}{2} + \frac{a_0}{6} &= \frac{1}{6} \\ ae_0 + e_0 + d_0 + \frac{c_0}{2} + \frac{b_0}{6} + \frac{a_0}{24} &= \frac{1}{24} \\ e_0 + \frac{d_0}{2} + a_0 c_1 + \frac{c_0}{6} + \frac{b_0}{24} &= \frac{1}{120} \\ c_1 e_0 + c_1 d_0 + a_0 c_2 + c_0 c_1 + b_0 c_1 &= \frac{1}{720} \end{aligned} \tag{2.4}$$

Solving these, we get

$$\begin{aligned} 1 \quad & a_0 = \frac{1}{(1+a)} \\ 2 \quad & b_0 = \frac{a}{(1+a)^2} \\ 3 \quad & c_0 = \frac{a(a-1)}{2(1+a)^3} \\ 4 \quad & d_0 = \frac{a(a^2-4a+1)}{6(a+1)^4} \\ 5 \quad & e_0 = \frac{(a-1)a(a^2-10a+1)}{24(a+1)^5} \\ 6 \quad & c_1 = \frac{(a^5-25a^4+70a^3-20a^2+5a+1)}{120(a+1)^4} \\ 7 \quad & c_2 = -\frac{(37a^9-1000a^8+1260a^7+1654a^6+2236a^5-288a^4-280a^3-10a^2-21a-4)}{2880(a+1)^8} \end{aligned} \tag{2.5}$$

To derive the above coefficients in MAXIMA we ran the following code in blue(output not shown here):

```
kill(all);

Define the equations (2.1) :
ub0:u0+h*u1+(h^2/2)*u2+(h^3/6)*u3+(h^4/24)*u4+(c1*h^5)*u5+
(c2*h^6)*u6;
ub1:u1+h*u2+(h^2/2)*u3+(h^3/6)*u4+(h^4/24)*u5+(c1*h^5)*u6;
ub2:u2+h*u3+(h^2/2)*u4+(h^3/6)*u5+(c1*h^4)*u6;
ub3:u3+h*u4+(h^2/2)*u5+(c1*h^3)*u6;
ub4:u4+h*u5+(c1*h^2)*u6;

Define the equation (2.2) :
uNew:a0*(ub0+a*u0)+b0*h*(ub1+a*u1)+c0*h^2*(ub2+a*u2)+
d0*h^3*(ub3+a*u3)+e0*h^4*(ub4+a*u4);

q:expand(uNew);

Define the LHS equation (2.3) :
uNewT:u0+h*u1+(h^2/2)*u2+(h^3/6)*u3+(h^4/24)*u4+(h^5/120)*u5+
(h^6/720)*u6;

Form the equation (2.3) :
eq:makelist(coeff(q, h, k)=coeff(uNewT, h, k), k, 0, 6);

Solve the equations (2.4) and simplify them :
sol:solve(eq, [a0, b0, c0, d0, e0, c1, c2] );
f:factor(sol);

Print the solutions (2.5) :
for i:1 thru 7 do print(f[1][i]);
```

3. Expressions for Derivatives

The expressions for the first, second, third and fourth order derivatives in [3] are:

$$u'_{i+1} = \left(\frac{\overline{u_{i+1}} - u_i}{120c_2h}\right) + \left(\frac{120c_2 - 1}{120c_2}\right)u'_i + \left(\frac{240c_2 - 1}{240c_2}\right)hu''_i + \left(\frac{360c_2 - 1}{720c_2}\right)h^2u'''_i + \left(\frac{480c_2 - 1}{2880c_2}\right)h^3u^{IV}_i + \left(\frac{5c_2 - c_1}{120c_2}\right)h^4u^V_i$$

$$u''_{i+1} = \left(\frac{\overline{u'_{i+1}} - u'_i}{24c_1h}\right) + \left(\frac{24c_1 - 1}{24c_1}\right)u''_i + \left(\frac{48c_1 - 1}{48c_1}\right)hu'''_i + \left(\frac{72c_1 - 1}{144c_1}\right)h^2u^{IV}_i + \left(\frac{96c_1 - 1}{576c_1}\right)h^3u^V_i$$

$$u'''_{i+1} = \left(\frac{\overline{u''_{i+1}} - u''_i}{6c_1h}\right) + \left(\frac{6c_1 - 1}{6c_1}\right)u'''_i + \left(\frac{12c_1 - 1}{12c_1}\right)hu^{IV}_i + \left(\frac{18c_1 - 1}{36c_1}\right)h^2u^V_i$$

$$u^{IV}_{i+1} = \left(\frac{\overline{u'''_{i+1}} - u'''_i}{2c_1h}\right) + \left(\frac{2c_1 - 1}{2c_1}\right)u^{IV}_i + \left(\frac{4c_1 - 1}{4c_1}\right)hu^V_i \quad (3.1)$$

where $u^V_i = f_i$.

The above equalities were verified by the following :
Assign the constants c_1, c_2 :

```
c1:rhs(f[1][6]);
c2:rhs(f[1][7]);
```

The equation for the first derivative in (3.1) :

```
D1:(1/(120*c2*h))*(ub0-u0)+(1-(1/(120*c2)))*u1+(1-(1/(240*c2)))*h*u2
+((1/2)-(1/(720*c2)))*h^2*u3+((1/6)-(1/(120*24*c2)))*h^3*u4
+((1/24)-(c1/(120*c2)))*h^4*u5$

expand(ratsimp(D1));
```

The equation for the second derivative in (3.1) :

```
D2:(1/(24*c1*h))*(ub1-u1)+(1-(1/(24*c1)))*u2+(1-(1/(48*c1)))*h*u3
+((1/2)-(1/(24*6*c1)))*h^2*u4+((1/6)-(1/(24*24*c1)))*h^3*u5$

expand(ratsimp(D2));
```

The equation for the thid derivative in (3.1) :

```
D3:(1/(6*c1*h))*(ub2-u2)+(1-(1/(6*c1)))*u3+(1-(1/(12*c1)))*h*u4
+((1/2)-(1/(36*c1)))*h^2*u5$

expand(ratsimp(D3));
```

The equation for the fourth derivative in (3.1) :

```
D4:(1/(2*c1*h))*(ub3-u3)+(1-(1/(2*c1)))*u4+(1-(1/(4*c1)))*h*u5$

expand(ratsimp(D4));
```

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MEDICAL SCIENCES

THE ROLE OF VACCINES IN HUMAN LIFE

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Abstract

Unlike most drugs, whose benefit is restricted to the individual who takes the drug, prophylactic vaccines have the potential for far-reaching effects that encompass health service utilisation, general health and wellbeing, cognitive development and, ultimately, economic productivity. The impact of immunisation is measured by evaluating effects directly on the vaccinated individual, indirectly on the unvaccinated community (herd protection), the epidemiology of the pathogen (such as changing circulating serotypes or prevention of epidemic cycles), and the additional benefits arising from improved health. Aside from protection of the individual, the broader success of immunisation is dependent on achieving a level of coverage sufficient to interrupt transmission of the pathogen. When evaluating the cost-effectiveness of vaccines, all of these potential benefits need to be accounted for. In many countries where immunisation programmes have been highly successful, the control of disease has meant that the benefits of immunisation have become less obvious. Once a well-known and much-feared disease appears to have disappeared, individuals, including healthcare professionals, no longer view ongoing prevention with the same sense of urgency. Reduced coverage is inevitably associated with resurgence in disease, with outbreaks potentially leading to significant morbidity and loss of life.

Keywords: immunization, proteins, toxoid vaccines, *effective*

Human use of preparations to prevent specific infections have been described since 1500 AD, beginning in China (Needham, 2000) where smallpox was prevented by variolation, which is the introduction of material from scabs into the skin. In 1796 in the United Kingdom, Edward Jenner observed the immunity to smallpox of milkmaids having previously had natural infection with cowpox (Jenner, 1798). He determined that inoculating small amounts of pus from the lesions of cowpox, presumably containing a virus related to vaccinia, into susceptible hosts rendered them immune to smallpox. The vaccine against smallpox was developed in 1798. The next phase of scientific developments involving the manipulation of infectious agents to extract suitable vaccine antigens took almost a century of research. Louis Pasteur's work with attenuation by oxygen or heat led to live-attenuated chicken cholera, inactivated anthrax and live-attenuated rabies vaccines at the turn of the 20th century (Pasteur, 1880, 1881, 1885). Alternative methods of attenuation using serial passage of Mycobacterium bovis led to the live Bacille Calmette-Guerin (BCG) (Calmette, 1927) vaccine, still in use today for the prevention of tuberculosis. Serial passage was also used in the development of yellow fever vaccines (Theiler and Smith, 1937a) which are grown in chicken embryo tissues (Theiler and Smith, 1937b). Whole cell killed bacterial vaccines were developed when methods to treat and kill bacteria through heat or chemicals were established and whole cell typhoid, cholera and pertussis vaccines resulted at the end of the 19th Century. In 1923, Alexander Glenny and Barbara Hopkins developed methods to inactivate bacterial toxins with formaldehyde, leading to the diphtheria and tetanus toxoid vaccines (Glenny and Hopkins, 1923).

Advances in virus culture in vitro allowed viral pathogens to be studied in greater detail and attenuation methods due to cultivation in artificial conditions led to the live oral polio, measles, rubella, mumps and varicella virus vaccines. In the 1960's at the Walter Reed Army Institute of Research, vaccines were developed using capsular polysaccharides (Gold and Artenstein, 1971; Artenstein, 1975), of encapsulated organisms including meningococci and later pneumococci (Austrian, 1989) and Haemophilus influenzae type b (Hib) (Anderson et al., 1972). To protect against multiple serotype variants of polysaccharide capsules, polyvalent vaccines were developed and later conjugated to carrier proteins to enhance their efficacy in infants in particular by recruiting T-cell mediated help to induce memory B-cells (Schneerson et al., 1980). Vaccines made solely from proteins were rare, with the exception of the toxoid vaccines, but the acellular pertussis vaccine containing five protein antigens, was developed to mitigate the unwanted effects of the whole cell vaccine (Sato and Sato, 1999).

The end of the 20th century marked a revolution in molecular biology and provided insights into microbiology and immunology allowing a greater understanding of pathogen epitopes and host responses to vaccination. Molecular genetics and genome sequencing has enabled the development of vaccines against RNA viruses possessing multiple variants of epitopes, such as the live and inactivated influenza vaccines (Maassab and DeBorde, 1985) and live rotavirus vaccines (Clark et al., 2006). DNA manipulation and excision allowed the use of surface antigen for hepatitis B viral vectors (Plotkin, 2014). The human papilloma virus (HPV) vaccine benefits from enhanced immunogenicity due to the formation of virus-like particles by the L1 antigen of each virus contained in the vaccine (Kirnbauer et al., 1992). Bacterial genome sequencing has provided in depth analysis of meningococcal antigens, to identify potential proteins for meningococcal B vaccines (Serruto et al., 2012).

Vaccine development was tested in 2020 when a novel coronavirus, SARS-CoV-2, emerged from China causing a severe acute respiratory illness, which subsequently spread globally. Within 5 months of the discovery of this virus (7th January 2020) (Zhu et al., 2020) and person-person transmission (Chan et al., 2020), 5,697,334 cases had been identified, with orders of magnitude likely not measured and almost no country escaped the pandemic. Owing to the previous advances in vaccinology, by 8th April 2020, there were 73 vaccine candidates under pre-clinical investigation (Thanh Le et al., 2020). Of these, six were in Phase 1 or 1/2 trials and one was in Phase 2/3 trials by 28th May 2020. The rapidity of this response demonstrated the ability to harness existing technologies including: RNA vaccine platforms (NCT04283461), DNA vaccine platforms (NCT04336410), recombinant vector vaccines (NCT04313127, NCT04324606) and adjuvants. The regulation, manufacturer and distribution of these vaccines will require expedition given the global public health need, from a period of many years to a matter of months. The efficacy and health impact of these vaccines is yet to be established, but if they are effective, then vaccines need to be made available for all global regions affected by SARS-CoV-2. The funding of this endeavor will prove challenging in a global context of national social and economic lockdown and massive government borrowing, but the justification for this provision will be through the multiple benefits to society that will need healthy citizens to rebuild economies in the decades post-COVID-19.

Establishing priorities for the development of vaccines against diseases prevalent in developing countries is complicated by large variations in the morbidity and mortality arising from such diseases, in their geographic distribution, in the extent of knowledge about relevant pathogens and host responses, in the resources and time required for vaccine development, and in anticipated vaccine efficacy and extent of use. This report presents a comprehensive method designed to help government decision makers set priorities for accelerated development of vaccines against important diseases in the developing world. The method can be used to assess new vaccine candidates or to reassess current contenders as additional information becomes available. The primary utilization of many of these vaccines would be for reducing morbidity and mortality in developing countries. Other uses would be for U.S. travelers to such countries, for military and other personnel stationed in them, and for response to the importation of these diseases (e.g., dengue fever) and their transmission in the United States.

The decision-making approach suggested uses similar kinds of information about the occurrence and importance of events that theoretically could be used in other methods of decision making. Because information is incomplete and because the method entails, in some instances, predicting the future, gaps must be filled by estimates or judgments by experts.

Providing a structural framework within which information and judgments are used and combined does not of itself improve the quality of currently available information (although further research to generate new data might be guided by such a framework). Nor does it reduce the range of opinion likely to be expressed in predictions, judgments, or estimates (except as issues are more precisely defined).

The committee believes that the system it proposes is the most appropriate for the desired purpose and has implemented it with the best available data and estimates. The committee believes that the system would improve the decision-making process by making it more accessible to evaluation and reconstruction by other decision makers and by facilitating examination of the effect of alternative assumptions or estimates. However, some cautions and comments are needed to prevent misinterpretation of the power and precision of the method.

To identify the components on which quantitative information is desirable (though not necessarily available), the system (more than others) exposes areas of ignorance and uncertainty in which expert judgment, by necessity, must be used. The proposed approach uses equations to define the way in which information or estimates are combined (something not always specified in other approaches); this does not imply that the components or the results have the accuracy sometimes associated with formal mathematical calculations. The results are simply the consequence of combining both factual and uncertain quantities, both objective and subjective elements, that are an inescapable part of reaching conclusions about the preferred investments in new vaccines.

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PEDAGOGICAL SCIENCES

PROJECT-BASED APPROACHES IN RUSSIAN LANGUAGE CLASSES: INTERDISCIPLINARY TEACHING EXPERIENCES WITH ARMENIAN AUDIENCES

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ПРОЕКТНЫЙ МЕТОД НА УРОКАХ РУССКОГО ЯЗЫКА: ОПЫТ МЕЖДИСЦИПЛИНАРНОГО ОБУЧЕНИЯ В АРМЯНСКОЙ АУДИТОРИИ

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Abstract

This article explores the implementation of project-based learning (PBL) in the context of teaching the Russian language and culture of speech to students in Armenian universities. It discusses the historical background of the project method, its relevance to interdisciplinary education, and the methodology for organizing project assignments on interdisciplinary topics. The study analyzes student preferences and the outcomes of their projects, highlighting the challenges faced during the application of the project method. Recommendations are provided to enhance the effectiveness of this teaching approach, emphasizing the importance of aligning project topics with students' professional interests, introducing intermediate assessment stages, and fostering collaboration among students. The findings indicate that project-based learning significantly contributes to the development of critical thinking, language skills, and cultural awareness, ultimately enriching the educational experience for students learning Russian as a foreign language.

Аннотация

В статье рассматривается использование проектного метода на уроках русского языка в армянской аудитории. Описывается история возникновения проектного метода, опыт его внедрения в образовательный процесс и актуальность для междисциплинарного обучения. Приводится методика организации проектных заданий для междисциплинарных тем, анализируются предпочтения студентов и результаты их деятельности. Освещены сложности применения проектного метода и предложены рекомендации для повышения эффективности обучения.

Keywords: project-based method, interdisciplinary learning, Russian as a foreign language, critical thinking.

Ключевые слова: проектный метод, междисциплинарное обучение, русский язык как иностранный, критическое мышление.

Введение

Проектный метод обучения, активно внедряемый в учебные программы и корпоративное обучение в разных странах, доказал свою эффективность как средство формирования критического мышления, самостоятельности и творческого подхода к решению задач. Этот метод берет начало в педагогических работах американского философа и педагога Джона Дьюи, а также его последователя Вильяма Херда Килпатрика. Дьюи считал, что эффективное обучение должно основываться на практическом опыте и активном взаимодействии учащихся с окружающей средой. По его мнению, обучающий процесс является неотъемлемой частью социальной жизни и должен быть направлен на решение реальных, значимых для учащихся проблем, так как это способствует глубокому усвоению материала и формированию умений применять знания на практике (Dewey, 1916) .

У. Килпатрик продолжил развивать идеи своего учителя, предложив использовать проекты как основу учебного процесса, где студенты учатся ставить цели, проводить исследования и представлять результаты (Kilpatrick, 1918). Он подчеркивал, что проектный метод, ориентированный на реальные проблемы, повышает вовлеченность учащихся и стимулирует их личностный рост . С тех пор метод проектов прочно вошел в систему образования и доказал свою актуальность не только в школьных, но и в университетских программах.

Сегодня проектный метод применяется в ведущих мировых компаниях и образовательных учреждениях. Так, в Google и Apple проектный метод служит основой для разработки новых продуктов и тестирования идей. В компании Google реализована политика «20% времени», которая позволяет сотрудникам выделять часть рабочего времени для работы над личными проектами, что способствует развитию инноваций (Schmidt & Rosenberg, 2014). Институт Массачусетского технологического института (MIT) и другие образовательные учреждения используют проектный метод для активного вовлечения студентов в процесс обучения через практические задания и междисциплинарные проекты, что особенно важно для развития профессиональных компетенций.

Проектный метод также поддерживают известные новаторы и исследователи, такие как Илон Маск (Tesla, SpaceX), Джефф Безос (Amazon), и Дэвид Келли (IDEO). Эти предприниматели убеждены, что обучение и развитие через проекты помогают специалистам эффективно решать реальные задачи и находить инновационные решения. Ведущие платформы онлайн-образования, такие как Coursera и Udacity, также включают проектные задания в курсы, особенно в области анализа данных и технологий, где обучение требует практического применения теории (Thrun, 2012) .

Все вышеперечисленные примеры подтверждают значимость проектного метода для современных образовательных и профессиональных систем, так как он способствует развитию навыков, необходимых в условиях быстро меняющегося мира.

Проектный метод активно используется в образовательных учреждениях по всему миру благодаря его способности развивать у студентов навыки критического мышления, самоорганизации и самостоятельного анализа. В армянских вузах проектный метод, применяемый на уроках русского языка как иностранного и культуры речи, помогает студентам использовать язык как средство исследования актуальных тем и профессиональных вопросов. В таком подходе студенты выступают не просто слушателями, но активными участниками учебного процесса, что особенно полезно для развития междисциплинарных связей и навыков анализа.

Для реализации проекта студентам первого и второго курса, обучающимся по различным направлениям («Юриспруденция», «Управление», «Актуарная и финансовая математика» и «Туризм») были предложены разнообразные темы. Темы предлагали широкий спектр вопросов для анализа, что должно было позволить студентам выбрать задачи, наиболее интересные с точки зрения их профессиональной подготовки. Однако на практике студенты предпочли темы, связанные с социокультурными проблемами, которые оказались для них более знакомыми и актуальными. Наиболее популярными среди предложенных 35 тем оказались следующие темы:

1. Влияние социальных медиа на психическое здоровье молодёжи;
2. Роль блогеров в выборе туристических направлений;
3. Реклама через социальные сети: как компании из разных стран используют TikTok;
4. Эволюция гендерных ролей в рекламе;
5. Армянская свадьба: традиции и обряды;
6. Армянская кухня: традиционные блюда и их значение;
7. Управление международными проектами: организация чемпионата мира по футболу в Катаре;
8. Реклама сладостей: как Kinder и M&M’s привлекают детей;
9. Реклама смартфонов: как Apple и Samsung привлекают своих клиентов;
10. Здоровое питание среди молодёжи: мифы и реальность.

На уроках РКИ проектный метод реализовывался следующим образом:

✓ **Выбор тем, связанных с русской культурой и профессиональными интересами**: Студенты выбирали проекты, которые были актуальны как для изучения русского языка, так и для их профессиональной сферы. Например, исследование традиций армянской свадьбы включало презентацию на русском языке, что стимулировало использование специализированной лексики и фразеологии.

✓ **Работа в группах**: Студенты разделялись на группы, что способствовало развитию навыков коллективного общения и взаимодействия. В процессе работы они обсуждали задачи, обменивались идеями и координировали действия, что требовало постоянного использования русского языка в живом общении.

✓ **Исследование и сбор информации на русском языке**: Студенты проводили исследования, используя русскоязычные источники, что способствовало расширению словарного запаса и улучшению навыков чтения и понимания письменного текста на русском языке.

✓ **Подготовка и проведение презентаций**: Финальной стадией проекта была презентация результатов. Это требовало от студентов не только знания материала, но и умения структурировать речь, использовать правильную интонацию и выразительные средства русского языка.

Хотя тематика была междисциплинарной, большинство студентов выбрали темы, связанные с медиа и культурными стереотипами. Такое предпочтение говорит о высокой степени вовлеченности студентов в вопросы, близкие их повседневной жизни, и подтверждает необходимость адаптации тем для каждой группы студентов с учетом их профессиональных интересов. Как показывают различные исследования, успех проектного Рассмотрим некоторые из популярных тем для проектной работы среди молодежи.

➢ **Социальные медиа и их влияние на психическое здоровье молодёжи**. В этом проекте студенты провели анкетирование, чтобы исследовать, как социальные сети влияют на самооценку молодёжи. Был проведен анонимный опрос среди студентов университа, в опросе участвовало более ста человек. Студенты проанализировали данные и предложили ряд рекомендаций по снижению негативного влияния социальных медиа на здоровье молодежи.

➢ **Эволюция гендерных ролей в рекламе**. В рамках данной темы студенты проанализировали изменения в гендерных стереотипах в рекламе за последние десятилетия, обсудив влияние феминистских движений на восприятие рекламы. Сравнили американские, английские, европейские и армянские особенности рекламы сучетом выбранной темы. Работа вызвала достаточно бурное обсуждение и спровоцировала дискуссию среди студентов.

➢ **Армянская свадьба: традиции и обряды**. Этот проект был одним из наиболее популярных и встречался практически на всех направлениях. Он

позволил студентам углубиться в культурные особенности армянских свадебных обрядов и сравнить их с современными изменениями, вызванными глобализацией, высказать свою точку зрения и обосновать ее.

➢ **Армянская кухня: традиционные блюда и их значение.** Необходимо отметить, что эта тема проектной работы была основате;на раскрыта многими группами, каждая из них подошла к реализации проекта по-своему, к примеру, одна из групп начала презентацию своего проекта под армянскую народную песню в традиционном армянском наряде – таразе, с традиционным армянским приветственным угощением – хлебом (испеченным ими же) и солью.

➢ **Здоровое питание среди молодёжи: мифы и реальность.** В ходе этого проекта студенты не только провели исследование и опрос, но и создали квест, который обеспечил интерактивный компонент и вовлечение аудитории в ходе представления проектной работы.

Таким образом, все выбранные темы проектных работ представляли высокую вовлеченность и мотивацию студентов и в процессе работы над проектами, и в ходе представления результатов проведенных работ. Презентации проектов стали важным элементом обучения, способствуя развитию навыков публичных выступлений. Проектный метод повысил мотивацию студентов к изучению русского языка. Работа над реальными и интересными проектами сделала процесс обучения более значимым и увлекательным. Студенты проявляли большую заинтересованность в изучении языка, стремясь использовать его на практике и достигать высоких результатов в своих проектах.Однако, необходимо выделить и проблемы, с которыми сталкнулись участники проектной работы. Рассмотрим их поподробнее.

Среди проблем, возникших у студентов, можно выделить следующие:

- **Неравномерный уровень подготовки**: Некоторые студенты имели недостаточный уровень владения русским языком, что затрудняло их участие в проектной работе и снижало качество устных презентаций.
- **Страх публичных выступлений**: У некоторых студентов наблюдался страх перед публичными выступлениями, что мешало им полностью раскрыть свой потенциал.
- **Недостаток времени**: Ограниченный срок выполнения проекта привел к поверхностному исследованию и недостаточному анализу среди некоторых групп студентов.
- **Плохая организация работы**: Отсутствие четкого распределения ролей и ответственности внутри группы приводило к неэффективной работе и снижению мотивации.
- **Низкая мотивация и поверхностный подход**: Некоторые студенты отнеслись к проектной работе несерьёзно, взяв короткий материал и создав небольшую презентацию, не справившись с поставленной задачей. Такие проекты характеризовались недостаточным исследованием темы, отсутствием глубины анализа и слабой презентацией результатов.
- **Индивидуальная работа**: Часть студентов предпочла работать индивидуально, что, в свою очередь, отразилось на качестве исследования и цели проектного метода. В индивидуальных проектах наблюдалась недостаточная интеграция знаний из разных дисциплин и ограниченный объем проработки темы.

Проектный метод показал свою эффективность в развитии критического мышления и умения организации работы в пределах выбранных тем. Однако результаты свидетельствуют о необходимости более тщательного подбора тем, соответствующих профессиональной направленности студентов, и более строгого контроля за процессом выполнения, так как среди проблем, с которыми сталкивались преподаватели, необходимо выделить следующие:

- **Преобладание личных интересов над профессиональными.**

Выбор тем, связанных с культурой и медиа, показал, что студенты предпочитают знакомые им темы, что говорит о необходимости более тщательной профессиональной ориентированности проектов.

- **Введение промежуточных контрольных этапов**. Регулярные промежуточные отчеты позволят выявить вклад каждого члена группы, что улучшит качество выполненной работы.
- **Сроки выполнения.** Следует учитывать, что проектная работа требует немало времени и усилий для качественного представления материала, однако университетские программы и часы, выделенные для уроков по русскому языку значительно усложняют поставленную задачу.

Проектный метод, успешно применяемый в образовательных учреждениях по всему миру, продемонстрировал свою высокую эффективность и в обучении русскому языку как иностранному в армянской аудитории. Использование проектного подхода на уроках РКИ создало условия для интеграции языковых, культурных и профессиональных навыков, что позволило студентам глубже понять материал, изучить его через актуальные для них темы и практически применять полученные знания. Данный подход помог значительно повысить интерес студентов к языковым занятиям, создав среду для активного и междисциплинарного обучения, которая стимулирует творческое и критическое мышление.

Как результат, выделим основные преимущества проектной деятельности на уроках РКИ в вузовском обучении.

❖ **Развитие критического мышления и языковых навыков**

Проектный метод способствует формированию критического мышления, так как студенты вынуждены анализировать информацию, сопоставлять данные и самостоятельно делать выводы на изучаемом языке. В процессе работы над проек-

тами студенты не только осваивали лексику и грамматические структуры, но и учились эффективно применять русский язык в коммуникации по актуальным профессиональным темам, что значительно улучшило их языковую компетенцию.

❖ **Вовлечение в изучение культуры и профессиональной лексики**

Студенты, анализируя темы, связанные с глобальными корпорациями, международными проектами, культурными особенностями и социальными медиа, знакомились с культурными и профессиональными аспектами русского языка. Такой подход значительно усилил мотивацию к обучению, так как студенты видели реальное применение русского языка в профессиональной среде и осознавали его важность для их будущей карьеры.

❖ **Формирование навыков командной работы и самоорганизации**

Проектный метод также показал свою ценность в развитии навыков работы в команде и самоорганизации. Студенты учились эффективно распределять роли, взаимодействовать, планировать и управлять проектом, что полезно не только для языкового обучения, но и для подготовки к профессиональной деятельности. Эти навыки, оттачиваемые в ходе выполнения междисциплинарных заданий, являются важной составляющей современного образования, ориентированного на компетентностный подход.

❖ **Необходимость дифференцированного подхода в подборе тем**

Результаты показали, что, несмотря на разнообразие предложенных тем, студенты часто выбирали наиболее знакомые и социально значимые вопросы, такие как влияние медиа или культурные стереотипы, избегая более сложных или специфических для их направления тем. Это указывает на необходимость более четкого подбора тем в соответствии с профессиональной направленностью групп, чтобы усилить связь между изучением русского языка и будущей профессиональной деятельностью студентов. Введение более специализированных тем для разных направлений подготовки поможет студентам глубже погружаться в профессионально-ориентированное изучение русского языка.

На основе проведенного анализа можно рекомендовать несколько подходов для оптимизации проектного метода в обучении РКИ:

1. **Поддержание междисциплинарных связей**

Проектный метод показал себя как инструмент, способствующий интеграции русского языка с профессиональными дисциплинами. Продолжение применения междисциплинарных проектов будет способствовать укреплению связей между изучаемым языком и профессиональными интересами студентов, что особенно актуально для современного образования.

2. **Введение промежуточного контроля и отчётности**

Для повышения ответственности и равномерного распределения работы рекомендуется внедрить промежуточные отчёты по проектам, что позволит оценить вклад каждого члена команды и предотвратить формальное выполнение заданий.

3. **Обеспечение индивидуальных заданий в рамках групповых проектов**

Дополнение групповых проектов индивидуальными заданиями позволит каждому студенту не только участвовать в общем проекте, но и вносить личный вклад, что также будет способствовать развитию личной ответственности и повышению заинтересованности в предмете.

В целом, проектный метод стал не только эффективным способом изучения русского языка, но и мощным образовательным инструментом, который позволяет студентам погружаться в язык через призму культурных, социальных и профессиональных аспектов. Этот метод делает изучение РКИ более осмысленным, актуальным и полезным для будущей профессиональной жизни студентов, а также позволяет образовательным учреждениям достигать более высокого уровня компетентности среди выпускников. Расширение применения проектного метода и учет междисциплинарных интересов студентов — это значительный шаг вперед в преподавании русского языка как иностранного и в развитии профессиональных навыков обучающихся.

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MODERN LEARNING METHODS IN THE DISTANT MEDICAL EDUCATION: EFFECTIVENESS AND WAYS OF IMPROVEMENT

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Abstract

In present work we described and discussed modern learning methods in the distant medical education, their effectiveness and ways of improvement. Higher educational institutions of medical education are faced with the need to master and implement new methods of digital media technologies and the application of digitization at all levels of training of medical specialists. A special place in collaborative medical education is occupied by Problem-Based and Project-Oriented Learning methods, which are based on an activity approach in assimilation and processing of information. Problem-Based and Project-Oriented Learning methods with Web Quests can be provided easily and widely into modern medical education process to improve the effectiveness of distance learning.

Keywords: distance learning, medical education, digital media technologies, Problem-Based and Project-Oriented Learning methods.

Introduction. The COVID-19 pandemic, wars and cataclysms all over the world have affected the way of teaching and learning in general and medicine education also. Higher educational institutions of medical education are faced with the need to master and implement new methods of digital media technologies and the application of digitization at all levels of training of medical specialists. Digitization of teaching and learning formats in education and training in the field of medicine requires the creation of didactic materials with digital support, the use of appropriate digital and communication tools, the implementation of the latest effective teaching methods, as well as the digital literacy of all participants in the learning process [1, 2].

Basically, distance learning, also known as digital learning comprises digital teaching materials, digital delivery, digital tools, and independent learning. It allows students to choose the way they study in a mixture of both synchronous and asynchronous variants without the restriction of time and location [1]. The development of an online platform especially the Learning Management System (LMS) offers a 'blended learning' environment for the students where they can communicate with lecturers, submit their assignments, discuss with peers, and share group work through the platform [3].

A student's educational motivation forms behavior aimed at academic achievement and is a key success factor, especially in the distsnt version of knowledge acquisition. Many factors influence learning motivation, including age and gender, interpersonal relation such as academic factors, cognitive and emotional characteristics of the learners and the learning supervisor, including anxiety and depression, and behavioral outcomes such as academic inclusion.

Aim of the study was to describe and discuss modern learning methods in the distant medical education, their effectiveness and ways of improvement.

Results and discussion. According to definition, «Distributed and distance learning is a varied and planned course of study, designed and developed to address the curriculum for students who are in different locations away from the central teaching institution, supported by teaching and supervisory staff who are also physically or virtually distributed across those locations. Distributed and distance learning is a whole-systems approach, including all teaching and learning, formative and summative assessments, feedback on learning, support for students and teachers, management, and quality assurance.

Distributed and distance learning can encompass technology-based and non-technology-based educational methods and experiences. Distributed and distance learning might refer to an entire course, or a part of it» [4].

A special place in collaborative medical education is occupied by Problem-Based and Project-Oriented Learning methods, which are based on an activity approach in assimilation and processing of information. Problem-Based Learning is a learning method in which real complex problems are used as an educational tool. Such training is based on problem solving, stimulates medical students to apply critical thinking skills to solve problems in a limited time, provides real experience that promotes an active learning process, helps to systematize knowledge and naturally integrates the educational process and real professional activity [2, 5].

Interdisciplinary in nature, problematic tasks differ among themselves, but there are some common characteristics:

– the problem should stimulate students to seek a deeper understanding of concepts or theories;

– the problem should require that the participants make informed decisions with further protection;

– the problem should contain such tasks that, in order to solve them, students need to connect them with previous courses or knowledge;

- the problem that is solved in groups should correspond to such a level of complexity to stimulate students to achieve a common goal [5].

Project-Oriented methods in distance education allow students to be involved in the active cognitive process, learn to work in cooperation, performing various social roles, obtain the necessary information and process it, argue and present the results of their activities.

Common features of Problem-Based and Project-Oriented Learning are:

– involvement of real problems and situations (for example, clinical cases and situations) in the educational process;

– are based on real educational goals;

– include intermediate (staged) and final evaluation of the work;

- education seekers - in the center of educational activity, the teacher - the head of educational research;

- motivation of educational activity;

– interdisciplinary;

- give an opportunity to practice the skills of cooperation, problem solving, applying critical thinking in the work process.

At the same time, there is a significant difference between Problem-Based Learning and Project-Oriented Learning: Problem-Based Learning focuses on a problem and the process of solving it, and for Project-Oriented Learning, the main goal is to get a final product [6].

Project-Oriented Learning in distance education is implemented through the Web-Quest method, which is created in order for students to learn how to use the received information for a practical purpose. Real placement of Web Quests on the network in the form of websites created by students themselves allows to significantly increase their motivation and achieve better educational results.

The development of project learning technologies, computer and Web technologies led to emergence and widespread use of Web-Quest technology in the educational process - pages on Internet sites that contain hyperlinks to other pages on a certain topic [7].

The Web-Quest method is a problematic task transformed into an interesting journey through the Internet with elements of a role-playing game, which involves queries in various search engines to obtain a significant amount of information, its analysis, systematization and subsequent presentation in the form of creative projects.

This method of interactive learning involves group work of three to five people and allows to increase motivation for learning, expand the professional intellect, develop search and research skills, the ability to use Internet resources important for learning, and develop creative thinking.

Web quests for solving controversial problems involve finding and presenting different, and sometimes conflicting, opinions on the same problem and trying to bring them to a consensus.

Analytical Web quest explores the relationship of real-world things within a given topic. Such tasks provide a basis for medical students to acquire knowledge in the conditions under which they have to carefully study things, find common and different, as well as find hidden similar phenomena, understand the connection of causes and effects, discussing their meaning.

Scientific Web quests serve to introduce and engage medical students in scientific research in various fields of knowledge [8].

Discussed effective learning methods do not cause difficulties in their application in the educational process, because they do not require downloading additional programs or possessing additional technical knowledge and skills. So, Problem-Based and Project-Oriented Learning methods with Web Quests can be provided easily and widely into modern medical education process [8, 9].

Conclusions.

Thus, distance education gives medical students access to non-traditional sources of information, increases the efficiency of independent work, provides completely new opportunities for creativity, finding and consolidating various professional skills, and allows teachers to implement fundamentally new forms and methods of learning which is naturally added to traditional medical education.

Distance learning involves an approach to the development of the whole course more than simply converting existing offline learning to other means or methods that are accessible to non-face-to-face students. Students and teachers involved in distance learning need special training, information, guidance and support.

Curricula for distance learning must be specially designed taking into account needs and circumstances of the learning environment of the students and teachers, it must ensure the same quality of education, teaching and assessment as on-site learning, including interpersonal interaction between students and communication between students and teachers. Providing regular personal feedback on student studying performance in distance learning should be constant and high-quality for both students and teachers.

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PHILOLOGICAL SCIENCES

MISSION AND CONVERSION: EXPLORING THE THEOLOGICAL IN LITERARY TRANSFORMATION

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Abstract

This article looks into both the theological themes of mission and conversion in modern literature and also mentions their development in the following two books: *The Immortalists* by Chloe Benjamin and *The Water Dancer* by Ta-Nehisi Coates. The research, by the detail and in-depth analysis of these books, exposes the spiritual growth and the quest for meaning in the narratives that are associated, on the one hand, with individual belief and, on the other hand, with wider social contexts. The issue of conversion in these publications is a very fertile source for the understanding of the complicated link between private faith and communal identity as well as how mission literature progresses to addressing the current existential dilemmas. Among everything else, the paper dissects the theological cloth through which such stories are woven, and brings up many issues related to the role of these stories in the distribution of faith, the way to salvation, and the idea of personal transcendence.

Keywords: mission, conversion, theological themes, literary transformation, spiritual journey, contemporary fiction

I. Introduction

In today's literature, spiritual journeys are sometimes referring to a deeper exploration of people's transformation, becoming a rich example of the themes of conversion and mission. The novels *The Immortalists* by Chloe Benjamin and *The Water Dancer* by Ta-Nehisi Coates that, respectively, show the two perspectives of a person's road of struggling with faith and redemption are the main subjects of the spiritual journey. Not only are these works stories of personal transformations; they actually are literary counterparts which reflect a society's expanding understanding of religion, recovery and working together.

Benjamin drives readers in *The Immortalists* to the lives of all four siblings; each of them is not only dealing with the uncertainty concerning their death but also faces the fact of knowing what their fates are. Conversion is, in this case, not just an expression of belief but a powerful act of letting go, as these people move along their paths, all the while trying to find meaning in the sky above, in the cloudy area below their feet, and in the time they have here. Analogously, Coates's *The Water Dancer* sheds light on a spiritual journey to liberation, not just from the physical shackles but from the historical trauma of slavery, thereby transforming the protagonist's odyssey into both personal and collective growth. The narratives of both novels rest on the basis of spiritual transformation, however, they are different from each other, in particular, the way they deal with the instruments that cause these changes. In The Immortalists, the exchanges with the future become the ground for their identity formation and provoke meditation on the essence of life with purpose. Each sibling's way of going to God is very different from others, including those whose pilgrimage consisted in getting rid of their destiny and those who preferred self-empowerment to fate. (Evans, 2021: 82)

On the other hand, *The Water Dancer* tells a story of spiritual rebirth through the challenges of historical trauma and the battle for freedom intertwined in multiple layers of deep meaning. Coates gives us a character whose road to freedom is tightly connected with ancestral memory and spiritual growth, as well as highlighting how collective memory is running individual's transformation. Although both novels demonstrate the theme of mission, their presentations of it are quite distinct. On the one hand, *The Immortalists* shows a more individual narrative, within the boundaries of fate, while, on the other hand, *The Water Dancer* defies the protagonist to go beyond personal boundaries and stick to a grander, more collective destiny that includes these legacies of spiritualities passed down for generations. The narrative in these two novels is the backbone to decipher what spiritual transformation is all about. In both books, the narration of the tale itself turns into a kind of mission; the imparting of wisdom, as well as a medium for personal and collective redemption, are both parts of a mission. Through richly layered character developments and smart plot movements, *The Immortalists* and *The Water Dancer* theme the theological in theological metamorphosis, explaining how foes can outgrow their difficulties through a faith-based mission. (Larkin, 2020: 73)

Whether as quiet, personal, and introspective moments or through large-scale acts of resistance against existing obstacles, the characters' spiritual journeys are marked by a significant engagement with the question of how somebody, yes, a person, can be changed, not only towards oneself but also for the greater good Through these narrative frames, the novels engulf each

other in a drug of issues about the relationship between a person's ability, to be born again, and the global mission of the human race.

II. Research methodology

The methodology for the investigation of the interrelation of mission, conversion, and spiritual transformation in the current fiction literature, taking the spiritualities *of The Immortalists* by Chloe Benjamin and *The Water Dancer* by Ta-Nehisi Coates as the starting point, is a mix of literary analysis, theological exploration, and interdisciplinary approaches. The nucleus of this work lies in the close reading of the texts, exploring the narrative strands of spiritual enlightenment, conversion, and mission within the broader changing developments of modern literature. In the sense that both of the novels in question reflect deeply on the themes of fate, family, freedom, and historical trauma, the focus of the analysis will be on showing the fact that both texts are in their own way treatment of the phenomenon of conversion - as not simply a religious experience, but as a creative development that can shape the lives of both the individuals and the communities. The methodology will include a theoretical framework that will combine literary criticism with theological studies. In conversion literature, the most important studies that are going to be the foundation of these essays are *Conversion in the Bible and The Qur'an* by Alan T. Davies, which will be the main source for exploring how the novels depict spiritual changes. Davies' work on scriptural transformation has played a pivotal role in the theological aspects of the idea of personal change which would also greatly contribute to argue with the novel that conversion as a transformational process of life is.

Furthermore, analogous theological themes in missions as delineated in the works of *The Mission of God* by Christopher JH Wright will be used for the examination of how missions either individual or collective correspond with their pursuit of meaning and salvation. Wright uses God as the center of the universe and He is the one who tells the truth to the people; thus, this study will provide a background for understanding the larger social context of the spiritual journeys in both the *The Immortalists* and *The Water Dancer*. This analysis largely will be branded using literary criticism; the researcher will use character analysis, plot development, and symbolism as the key instruments in the literary criticism of them. That such learned men as Mikhail Bakhtin, including in his dialogic work, and the interaction of voices in narratives, will be of great benefit in characterizing the characters' spiritual ascents as dialogues with the self, the fate of the universe, and the faith. Further analysis of the text will involve postcolonial stance, for instance, the dominance of historical trauma and the slavery legacy in *The Water Dancer*.

The postcolonial readings of Coates' novel will, particularly, be done in tandem with Fanon's masterpieces such as *The Wretched of the Earth*, which will clearly reveal novel sets of freedom emancipation, and spiritual liberation. Fanon an essential element of his work criticized colonial power structures will be instrumental in comprehending Coates' stylistics of personal and collective missions through the layers of his protagonist spiritual ascent. Furthermore, this research will be of a qualitative nature, which will focus on the text of the selected passages that expose the characters' spiritual journey. This will be accompanied by a critique of critical reception from academic journals and essays that focus on the issues of both *The Immortalists* and *The Water Dancer* in relation to recent material and immaterial developments. This study, as well, will focus on the social and cultural contexts of the novels, especially in terms of how they reflect contemporary concerns about identity, legacy, and the search for meaning in the face of trauma.

III. Theological underpinnings: conversion as a literary theme

The enquiry of conversion as a literary theme in recent fiction revealed the truer considerations of the connection between inner transformation and larger Christian concerns like faith, redemption, and divine intervention. The writer Chloe Benjamin uses a technique of intertwining religious allegories and theological concepts into her characters' lives whose spiritual quests are heavily influenced by the overpowering threat of death. The novel portrays every sibling as having a different destiny and uses these stories to disseminate the theological interpretation of predestination with accuracy. Their encounter with their prospective extinction initiates a search for the meaning of life that is, in effect, the true conversion of the being's spirit. The theological nuances in *The Immortalists* are a symbolic representation of the pursuit of salvation and the strengthening of faith, yet not in the conventional religious manner. While they are wrestling with their mortality, each character's journey is a meditation on the contradiction that exists between fate and free will, a theme which is quite similar to the Calvinist doctrine of predestination; although, it is still presented in a non-religious context. (Jones, 2021: 88)

As a result, on the part of the reader, the masterpiece grounds the reader to think about the divine levels of knowledge and authority, each, in turn, playing its role on human agency and belief. On the contrary, *The Water Dancer* by Ta-Nehisi Coates paints the story of conversion against a background of historical and cultural trauma, particularly the history of slavery. An authentic portrayal of the route to freedom for the main character Hiram Walker comes from a spiritual and physical liberation form. The interaction of freedom and spirituality is put into sharp relief by the introduction of Coates. The author through the use of sharp imagery depicts The Conduction as a supernatural mechanism of not only slavery's literal but also metaphorical escape facilitating awakening that checks across the group. *Freedom is a freedom to do thing*s - they get it through taking it, a power so strong only God can give. Hiram's journey to the liberation of his personality is not a physical one correct, but it is also very spiritual as he experiences his own inner screams and soldierings caused from his quest for inner peace. (Patterson, 2021: 162)

Spiritual Conversion in *The Water Dancer* is an idea based on liberation theology and one of the conceptions is that true freedom is leaving the oppressors

and be at peace with your soul. Coates, without shackling himself to any particular religious order, provides a dramatic demonstration of some of the theological issues of suffering, the redemption and the desire for transcendence. One or the other novel is about the process of changing faith, and yet, by the way, each of them departs quite oddly from the theme. Thanatos is a personification of the introduction or awareness of death, which often turns into soul-searching and the making of ethical decisions. As a result, the characters get to the stage of personal conversion. The individual's journey towards themselves is mainly due to existentialism, thus the theological concept that *conversion is an experience of the awareness of being mortal and limited* is emphasized. (Hayward, 2020: 91)

IV. Spiritual conflict and transformation: characters in crisis

Chloe Benjamin in *The Immortalists*, the underpinning therefore the spiritual conflict and transformation are the existential crises of the characters that can be the foundation for their flourish, therefore creating a unique masterful narrative in which she explores the spirituality of the characters. The story of the siblings is based on the prediction of their inevitable death which they knowingly and creatively act on to bring about individual but hazardous authentic journeys. Through their knowledge of their lives, the theological aspects of their lives are now realized based on their decisions, and also how they relate to fate, destiny, and free will. As the tangle of children attempts to come to terms with the mortality, Benjamin helps the reader to discover the deeper aspects of Christianity. The Christian existentialism, the search for meaning is the human act of trying to reconcile one's mortality with the possible timelessness of meaning. The divine plan and free will of humans are the central theme of the characters' spiritual developments as they undergo the pain of a negotiating existence that they cannot control beyond their understanding. (Shaw, 2021: 53)

The theological opposition in *The Immortalists* is a clear sense of the truth that life is a wider human condition that we need to reflect on how we can live truly and contentedly despite the fact that we have to deal with our mortality. In *The Water Dancer*, Ta-Nehisi Coates pastors an altogether newer but nevertheless deeply affecting version of spiritual conflict and its expression. Hiram Walker the protagonist is in a faith and identity conflict which is a result of the very fact that he is not just in the process of achieving physical freedom but also spiritual liberation. Coates actually juxtaposes Hiram's case of self-realization in the overall slavery and brutalization storylines as well, thus freedom fully not only physical but also a spiritual area of manifestation within the courses of history. The film shows the initial distance between Hiram and African Americans, as well as himself, which is a metaphor for the spiritual breakdown that has been experienced by many people in the context of systematic oppression. (Mitchell, 2019: 51)

During the storyline, however, Hiram finds spiritual truth through talks with metaphysical concepts in the novel, particularly, through the presence of conduction. This supernatural ability to travel out of remote areas is suggested to be freedom that Hiram strives for as he communicates with his past and his ancestors, and finally, with his inner soul. It can be seen from the theological side that Hiram will now be in the process of liberating theology that shares the view that the emancipation process is not only political or social but mainly spiritual. His relatives' religion loses its meaning and through the new religious system of his life, he experiences God's free will and friendship through the truth he finds in himself and grounded interactions with his community. (Patel, 2021: 173)

The influence of spirituality on personal development in the novels is also demonstrated by the fact that they make the issues of spiritual conflict and personal identity visible and thus they tackle the complex issue of living a life that is not in sync with the spiritual reality. Both books present stories that correspond to the quests of the characters who are continuously driven by the desire to find the key to the riddle of their restless soul, the confrontation with the impending date of death or the battle for liberation from the bondage of slavery could be the case. On the one hand, spiritual growth is not the primary aim in any of these works, and on the other, it is a significantly transformative path that corresponds to the characters' level of understanding of self, fate, and faith. Spirituality as depicted in these novels is an aspect of the great human quest for existence that addresses issues like redemption and transcendence which provides a detailed analysis of how literature is related to theological themes and hence attracts the modern audience. (Brown, 2020: 44)

V. Mission and meaning: religious themes as social commentary

In *The Immortalists*, Chloe Benjamin creates a touching story that along with the main character, brings to light the broader issues of life and society. In their own ways, the siblings make the experiences of the knowledge of their eventual futures also the basis for their searches for truth that are deeper and more metaphorical and last longer when dealing with questions about fate, identity, and the human condition. The novel's leading theme is the personalization of the task which requires each character to find their own meaning in a life determined by both the known and the unknown. In their personal quest, the siblings' every little action (be it a relationship, career, or the choices made) turns into an actualization journey that gives them life meaning. (Davis, 2021: 173)

Through their personal experiences, the novel elucidates the interconnection of individual change to social commentary on free will, family, and the societal pressures that have a bearing on persons' lives. The religious elements in the story such as the search for redemption, faith, and spiritual resolution which are pertinent to contemporary readers who also confront their own questions about the meaning of life in an uncertain world. *The Immortalists* turns the tables on the human being's supposed destiny and poses this as an internal reaction to social phenomena, thus, a critique of the human desire to be the master of one's life. In *The Water Dancer*, Ta-Nehisi Coates sneaks the book to a level where religious and spiritual themes are slimmed all the

way to personal and common mission as tight as personal change around the thread of life. It is a story of Hiram Walker, a man who was born into slavery and has to resist cleverly both these material and spiritual chains, that frames the union of the mission and social change in the clearest way possible. Hiram's personal liberation is just as much about a whole and larger group that is striving to achieve the same as it is about an individual. The additional element of the story, *Conduction,* which enables Hiram to overtake his obstacles is a tool for his personal spirituality to rejuvenate, turning a good example of a possibility of personal change can lead to social change. (Fischer, 2019: 159)

Hiram sets a meaningful target that is incorporated in the Underground Railroad project, a collaborative effort that apart from giving cover to him, creates faith, resistance, and redemption. Additionally, Hiram's story is one that shows a forthcoming worldwide change by way of an elaborate network of underground activists, which Hiram gets the privilege to be a part of. Coates's skilful blending of individual and collective aspects in *The Water Dancer* gives the idea credence that spiritual rebirth should be shared which may inspire progressive justice and equality. (Schultz, 2021: 124)

Both *The Immortalists* and *The Water Dancer* bring forth the theme of mission in a way that it can evoke the religious and spiritual concerns of modern-day society. The Imaginarium project of the protagonists in *The Immortalists* becomes the de facto catalyst for them to come to grips with the stark reality of modern individualism, which is the only force left, in our culture, to guide them in that. This also conveys that the road to freedom from the rigid social roles of post-industrial times lies in the openness and outlying nature of the social relation. Equally, *The Water Dancer* contends that *the Spiritual renewal of an individual is intrinsically related to the community and is not merely a personal matter*, though the personal development and change in the group are taking place. Faith, fate as well as individual freedom issues are the topics of two novels that behove the reader to grasp the vital importance of the religious and spiritual world in the personal and social life of the human species, thus today even the most common societal problems can be solved. These books with their vibrant descriptions of the inner lives of the characters clearly show that the issues of faith and religion are still in the foreground of literature in that they provide new and fresh angles to the concept of a personal versus shared mission from the historical and social context. (Williams, 2021: 143)

VI. The impact of conversion: character arcs and theological development

In her book *The Immortalists*, Chloe Benjamin downplays the confined and exuberant picture of four physics majors in Manhattan engaged in escapism, but the ambiguous interpretation that people can achieve personal autonomy remains. Each of the siblings, knowing exactly the dates of their death, is transformed and their self-conception and place in the world is redefined. The due date, however, sucks them into the long-term effects of having knowledge of their deaths, predecessors of personal development, strife-tumult, existential crises, repairing relationships, and redirecting their lives. An example is Simon, who is restless and is engaged with emancipation from the influence of societal expectations, and with experimenting with his sexuality. His conversion, however, can never be a transient one for he has to go through the long process of integrating who he is with who society wants him to be. Similarly, Klara's road trip is the one of spiritual and creative mutiny by getting meaning through her work as a magician; however, she is also wrestling with the limitations set by the past. (Robinson, 2020: 177)

The continual forge of their conversion exceeds the personal tracks and interacts with the dominant theme of the novel which deals with fate and freedom. The theological repercussions of the spiritual journeys of the characters are critiqued, and the concepts of redemption and salvation are put into a question mode, and it shows that conversion might not bring peace but rather a continuous inner inspection and self-discovery. Through these real-life character graphs, the author shows that conversion, both personal and spiritual, ultimately reforms their characters in a way that goes beyond them and affects their relationships with others and their understanding of life. *On the Water Dancer*, by Coates Ta-Nehisi unveils a powerful argument, the plot of spiritual conversion as an instrument of liberation from historical and generational trauma in the novel. The main character, Hiram Walker, comes through the experience of change and development in such a way that his personal freedom is linked to the freedom of the whole nation. Not only does Hiram's conversion religion get one's own conversion but his muscles of spiritual awakening and memory of ancestors. (Sullivan, 2020:102)

His discovery of his abilities, namely the mystical power of conduction, becomes a powerful symbol of his struggle toward freedom, physical and mental slavery, and the psychological wounds of inherited trauma as well. As Hiram learns how to use his powers, he also learns to break the chains that have tied him to his history and his place in the world. The time of spiritual conversion, as it is portrayed, not only the individual experience but also a whole is engaged act when Hiram's released potential affords him henceforth to participate in the underground railroad by force of enacting massed liberation movement. Hiram's spiritual conversion, in a way, is analogous to cutting the historical thread of slavery and thus escaping spiritual bondage. The novel proposes the usage of spiritual transformation to transcend traumatic situations, besides helping an individual, it can also be a kick-start for healing communities. Coates' portrayal of conversion is more about showing that the effect of such a change is not ephemeral but is a serious reshuffling of Hiram's role and identity in the context of the greater struggle for freedom. (Miller, 2020: 69)

Both *The Immortalists* and *The Water Dancer* embrace conversion as a mighty and earth-shattering phenomenon. In Benjamin's novel, the conversion inherently means stewing in the mixture of personal and psychological dilemmas by trying to predict the future and also the connection of religiousness to self-discovery that could be painful at the same time. However, in Coates' view, conversion is the only way to escape the

physical confines of the past, thus, he reconstitutes the old world and remakes the whole of society. The two novels, one via conversion as a process of change in the identities of the characters and, on the other side, through the questions of freedom, fate, and the possibility of redemption theologically reclaimed. The multiple and multi-layered characterizations of change that are dwelling in the different authors evoke the new realization that conversion might do more than just confuse people, it might even become a very invalidating experience for them when they look for the meaning and place of the Self through the social prism have been offered by this. The divine repercussions of these phenomena have gone as far as history and society, wherein they reflect the characters' lives. (Green, 2020: 188)

VII. Conclusion

The modern novel has metamorphosed the attitude toward mission and conversion, it has shifted from the traditional focus on the salvation of an individual to the more inclusive point of view exploring collective uplift and societal transformation. On the one hand, Chloe Benjamin's *The Immortalists* and Ta-Nehisi Coates' *The Water Dancer*, the idea of conversion is not only a personal way of redemption, but it also is an experience that is mutually felt and that formation is tied to broader societal changes. The heroes of these novels, who are in their own crises and, at the same time, are in search of meaning, co-operate with the larger communal and historical struggles that are at the same time the main story. This change is representative of the deeper theological issue that is the link between human experiences and the broader mission of healing and fixing the collective suffering and injustice. For example, in *The Water Dancer*, Hiram's spiritual transformation is a part of the entire nation's mission of emancipation, hence, in this way, it is shown that personal freedom can be seen as a process that is bound to the liberation of others.

The Immortalists is a similar case when it comes to the knowledge of one's fate which is the primary source of personal and relational dislocation, with each character's way of life corresponding to the subject of individual's role in the larger web of human existence. This newest approach to mission and conversion departs from the old theological framework, which concentrates on the individual soul's salvation only, and it instead presents a dynamic, relational view of man's existence. Both authors create a narrative of social and historical contexts in which spiritual transformation is relevant to underline that a mission that involves only personal redemption and lift-up of the individual only is no more possible; it has to be a collective phenomenon. The theological implications of these novels actually go much beyond the personal and thus they interrogate the moral and spiritual duties of individuals in relation to their communities. The process of conversion thus is a vehicle through which both personal and collective liberation is achieved and thus, it is a novel way in which mission could be depicted in contemporary fiction.

Besides, the theological investigation in *The Immortalists* and *The Water Dancer* also points out that it is still relevant to deal with spiritual and religious themes in the contemporary literature. The novels present the constant need to deal with existential issues of meaning, identity, and the moral imperatives that guide human lives. The characters' endeavours for transformation, which are the timeless human struggles for the purpose in the face of loss, suffering, and historical oppression. Hence, they deal with those theological issues that are way beyond any one particular religious belief and provide a broader, more open-minded, and inclusive approach to the exploration of faith and spirituality. These works argue that despite the fact that the world is becoming more and more secular, literature is still a very important place to explore the human condition and the search for redemption. As these characters go through the ordeals of their time, their stories, which are about the universal craving for transformation and healing, become the works that are mandatory in the dialogue about mission, conversion, and theological thought in contemporary fiction.

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MAIN CRITERIA PROVIDING EFFECTIVE LANGUAGE ACQUISITION

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Abstract

The article elaborates major criteria that determine effective language acquisition. Quality of the education is synchronically related to learning criteria. Visibility and responsibility are considered very vital criteria for effective language acquisition. We should learn the process of foreign language learning more profoundly to provide a wider range of learning outcomes. The procedures, learning atmosphere and outcomes are interrelated in any learning process. The quality of the outcomes is up to the type of procedures and the learners' learning experience. For this reason, investing pedagogical expertise in the educational process also involves an investment in the quality of learning outcomes. There are more criteria which help language comprehension deeply.

Keywords: effective, language acquisition, criteria, skills, competent, comprehension

INTRODUCTION

There are some criteria that have positive impact on the effectiveness of language acquisition. Responsibility and visibility can be considered main factors in effective language learning. We are usually prone to think that the outcome of the language learning is the student's communication competence that can be evaluated by means of different performances and proficiency tests. Competent and valid communicative performance examination provides an important assessment of the language learner's communicative skills [5]. One can find popular distinctions in the learners' language skills and competent testing procedures can reveal such distinctions.

Nevertheless, focusing on skills-oriented proficiency tests lacks numerous other vital outcomes which are obvious, especially in the aims of teaching languages for the student independence and communicative inter-cultural competence. Inter-cultural competence is built up on communicative competence. However, communicative competence is related firstly to the language speaker's skills and knowledge in interactive situations, inter-cultural competence also concentrates on social and personal capabilities of the language user. Then it underlines the significance of linking to otherness and foreignness in human meetings. It underrates the tolerance of ambiguity and respect for difference in inter-cultural relations that depend on expectations and situation-specific cultural norms [8].

Social and personal learning appropriate for the purposes of inter-cultural competence are invisible in the proficiency tests which are conducted by external examination boards or testing agencies. We should learn the process of foreign language learning more profoundly to provide a wider range of learning outcomes. The procedures, learning atmosphere and outcomes are interrelated in any learning process. The quality of the outcomes is up to the type of procedures and the learners' learning experience. For this reason, investing pedagogical expertise in the educational process also involves an investment in the quality of learning outcomes. There are more criteria which help language comprehension deeply. One of these criteria is visibility in language learning process.

LITERATURE REVIEW

There are a myriad of studies regarding effective language acquisition conducted by researchers among whom we can find Akbari Z, Beattie M, Brown H, Babayev J, Carver D. J, Lehtovaara J, Kohonen V, Jaatinen R, Lamendella T, Muchiri M. N, Njogu K, Scovel T, Swain M, Trim J and many others. The topic of effective language learning or acquisition has always been an actual topic for language learners and teachers. Different hypotheses have been set forth about effective solution on this topic. However, research on the so-called topic is still being carried out by famous scholars who make a rigid research on the very topic.

MATERIALS AND DISCUSSION

Being responsible for language learning

Developing learner autonomy while learning a foreign language needs time, pedagogical skill and responsibility for self-study learning. This can be fulfilled through online and offline learning [3], [4]. As David Little shows, learners don't become autonomous students just being told that they are liable for their learning. They might manage more aspects of the learning process till they get adequate knowledge, motivation and skills. In order to take responsibility of their learning and improve their skills they should actively be involved in the complete learning process. Leslie Dickenson suggests to develop independent learning for the broader range of knowledge, skills and attitudes which the teacher should work on with the learners:

1. To justify and legitimize autonomy as a learning aim and to encourage the students to take a more independent approach to the learning process.
2. To convince the learners that they are able to assume autonomy if they make a strict attempt to learn something by assisting them gain successful experience.
3. To assist them to comprehend the language as a linguistic system and improve their communicative skills.
4. To contribute the students to comprehend a lot about the language learning and improve awareness of what is involved in the learning process.
5. To enable them to tackle emerging challenges in interaction and learning and overcome the impediments .

6. To help the learners to boost obvious learning strategies to make a plan, monitor and reflect on their learning.

7. To provide the learners with concrete opportunities to experience bigger independence in their language acquisition.

Visibility in language learning

What is meant by visibility is that language tests bring about language comprehension which makes the students understand the language with receptive tests and then the students make themselves understand them with productive tests. When language tests are given, especially to many test takers simultaneously including school leaving tests, the restrictions of economical and reliable scoring mean that the types of the tests involve mainly cognitive skills and narrow language which include gap-filling tests, multiple choice questions and open tests [6].

While standard tests give important information about the skills assessed, they can have a less desirable pedagogical wash-back effect which has been carried out previously. For understandable reasons, the teachers are forced to train their students to pass the test with excellent marks. Moreover, the capacity of standard tests to provide useful data for pedagogical learner guidance is also restricted depending on the open-endedness of the tests employed [11].

Learning a language inherently involves numerous private features and process-related learning outcomes which are educationally assessable language learning purposes in the language curriculum. In most national contexts, these educational purposes are also represented in curricular frameworks demanding all the teachers to imply them in their subject curriculum. This underlines the aims of improving a holistic learner development, learning responsible moral and social education [10]. For learning a foreign language, particularly a natural purpose is to develop inter-cultural language competence underlining the language speaker's ability to meet otherness respecting cultural difference.

It is vital to stress that the learners inevitably bring their own histories or autobiographies to classes.

These autobiographies reflect personal features, beliefs and assumptions of the language and learning that have emerged as a part of their learning history in their families and at school. These properties develop in relation with the affective, cognitive and social language learning processes [7]. They have a negative impact on the learner's observable language performance. While they are mainly invisible, especially in the paper-and-pencil tests, they have some features which are important for the improvement of language competence and motivation:

a) Liability to and mastery of one's language learning

b) Ambiguity tolerance and indefiniteness in communicative environment and language learning in general

c) Willingness to venture in order to manage communicative tasks and situation.

d) Comprehension of yourself as a language learner and user from the perspective of beliefs about language employment and you role as a student.

e) Attitudes and skills for socially liable, negotiated learning and language usage.

f) Learning strategies and skills important for consistent increasingly autonomous language learning carried out in the social student communities and in communication with other students and teacher.

g) A reflective main orientation to language learning with skills for critical self-evaluation and peer-reflection.

Features such as these are important for developing student independence, inter-cultural interaction and learner's own development [5]. They are an integral part of the pedagogical learning process in any language classroom, irrespective of the extent to which we know them as teachers [10]. To develop foreign language knowledge, we should heed more professional attention to such features.

In most cases, above-mentioned student features are not seen in external testing and may be inferred only indirectly from the learner's linguistic output information [1]. They can remain consciously unreachable to the learners in the process of learning until we render an explicit attention to them. Thus, they make up the so-called confidential, invisible curriculum of which learners have a peripheral awareness. The learners can have hardships in guaranteeing a conscious reflection and evaluation of language learning without awareness of learning means for them in their own views [2]. Likewise, the teachers can find it hard to conceptualize their role as mediators in student learning. It can be hard to negotiate the procedures, to provide teaching and assess the total range of learning outcomes without sharing the concepts to speak about. Students and teachers, for this reason, need a denominator language and concrete methods for the pedagogical teaching, monitoring and language learning reflection.

CONCLUSION

It is important to demonstrate what we mean by the concept of learning outcomes in learning a language targeted at consolidating student autonomy. We should attentively take into consideration how we realize appropriate notions in cultural meanings and how we can teach them to the learners. This type of thinking and re-examination is important during the learning process with the same student groups since the opportunities will change during the work course. For this reason, it is advisable to clear up professional comprehension of the key "what" question at relevant intervals also basing our presentations on actual observation and information obtained from concrete learning environment and papers. It is also essential to conduct regular pedagogical discussions in supportive teacher staff [9].

The above-mentioned features naturally exist in language classes in various national and regional meanings. For this reason, any pedagogical progress work should be undertaken within regional, national and local contexts. The research is launched, carried out and assessed by national experts.

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BEYOND THE MOORS: GOTHIC THEMES IN CONTEMPORARY BRITISH CLIMATE FICTION

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Abstract

This research of the process of the introduction of Gothic motifs into British climate fiction shows how Gothic motifs are being reproduced in the genre. Through investigation of motifs such as solitary deconstructed areas and supernatural creatures coming together with environmental issues will bring the point across at the fearful feelings of people in a world suffering the climate. By illustrating, via two contemporary examples, how nature and environment are the Gothic antagonists and manifest the story through these devices, the authors (Chloe Benjamin's *The Immortalists* and Ta-Nehisi Coates' *The Water Dancer*) display the depth and extent of the characters' fear tied with ecological deterioration. To add that, such motifs as alienation, human frailty, and the fear of the unknown may be just a writer's tools but are represented as a criticism of the environment, thus Gothic horror expressed the same moral that environmental destruction do. Furthermore, this paper drives a point that the Gothic narrative not only provides an eternally mysterious and ambiguous background but also uses it to create symbols that show the effects of weather deterioration, and thus, it becomes a link through the literary genre to modern climate issues. In conclusion, the combination of research and literary means comes to the table that British climate fiction goes beyond the orthodox environmental narrative description and artistic creation through the engagement with Gothic motifs, enables pertinent social critique.

Keywords: Gothic fiction, British climate fiction, environmental themes, ecological Gothic, isolation, climate collapse

I. Introduction

Over the past few years, British Gothic fiction has successfully managed to create a unique narrative about climate change by intertwining it with a mystical literary style filled with thoughts of destruction, solitude, and fear. Now, this Gothic style, intrinsic to British literatures, is once again applicable, as writers join the debates surrounding environmental issues. These landscape modifications result in hazardous areas and the consideration of nature as horrifying have been adopted from the Gothic tradition to tackle the humanity's sometimes poisonous relationship with nature by these writers. Such kind of novels is Sarah Moss's *Ghost Wall* and Andrew Michael Hurley's *The Loney* that are exactly the examples of collisions between two worlds, where nature, which is not always safe and easy to control, is fearful thus the world becomes dually nice and scary. Moss in *Ghost Wall* effectively describes such a place where one feels cold and even aggressive sometimes, thus, highlighting the fact that nature is indeed very much powerful and apathetic to humans that are defenseless in coping with it. One of the vital aspects of the revival of English Gothic literature is that it gives the authors an opportunity to critique the alienation of modern society from the environment as well as to imply the environmental change in a way that is both successful and emotionally stirring. (Francis, 2020: 16)

Authors such as Naomi Booth, whose most recent novel *Sealed* is an example in this case, resort to Gothic themes to portray environmental destruction as a horrible scene in which the air is poisoned and dermal infections are fatal thus inciting bodily horror which is the epitome of human contributions to the severity of nature. More often than not, these accounts employ traditional Gothic spaces such as decayed houses, isolated places, and rural areas to express both the emptiness of nature and the feelings of detachment suffered by the inhabitants of the damaged ecological regions. To be more specific, modern British climate fiction is an artistic vein of the Gothic tradition, which is to say that the gothic conventions of the destructive and the sickly are the springs from which the natural forces, now the main characters, of the narratives arise. (Lawrence, 2021: 27)

At the core of this argument is the Gothic idea of decay and stasis which is a side note to nature's assault on the world, thereby, together, they make a proper vehicle for studying environmental issues. Still, far from being a bane, this writing method instead shows how the genre communicates human adverse emotions and the fact that this once beautiful and untouched sphere of our existence has become a plague that leaves people defenceless. Daisy Johnson in *Everything Under*, for example, manifests the wild side of nature as a character which still has the potential to become a monster, and somehow, that forces people to realize how negative they have been in their ways of interaction with the natural.

II. Research methodology

The methodology adopted for this study concerning the gothic thematic in recent British climate fiction is highly interactive between close textual analysis and exploration of the contextual field, thus, it aims at revealing a number of ways in which the environment is being overburdened and disordered within the gothic aesthetics. The material is basically the data from a close study of given books like Sarah Moss's *Ghost Wall*, Andrew Michael Hurley's *The Loney*, and Daisy Johnson's *Everything Under*, which were used as a

means to analyse and demonstrate how a creative imagination could be the soliloquy of the environmental fear. The scheme appears to be quite Gothic as the authors resort to surrealist portrayals of nature in order to depict the concept of alienation and the human slavery to the natural world. Therefore, the emphasis is given to the analysis of selective diction, imagery, and narration of each of them, which thus, happen to show how the Gothic poetics become a very convincing tool for responding to the modern ecological crisis. Other than that, this research will also confine itself to an interdisciplinary methodological research paradigm that will consist of relevant concepts from the fields of eco-criticism, Gothic studies, and environmental humanities for an even deeper analysis of the primary texts.

Eco-criticism, such as that explored by the likes of Timothy Morton and Greg Garrard, each of them gives a clear insight into how literature could both be a cause and a result of the environment's conscience. Moreover, Morton's oblique notion of *dark ecology* placing the relation of all life above any subject being now and unsettled, that is, nature is essentially a connected organism, is an imperative concept in British climate fiction related to the gothic atmosphere of isolation and alienation. By utilizing the theory of Morton in the works of Hurley and Booth, the study strives to demonstrate how the imaginative characterization of ominous landscapes and hostile nature evoke the sensation of otherworldliness and unease that are characteristic of the Gothic genre and also to point out how some texts suggest that climate change is a presently existing problem.

Additionally, the historic perspectives on the gothic tradition highlight the continuous and articulated manifestation of this particular genre in the British imagination, also its function to channel the latent fears of society. The analysis draws on the criticism of classical Gothic fiction by academics including such figures as David Punter and Eve Kosofsky Sedgwick, and thus the study approaches the identification of Gothic motifs reimagined in a climate fiction context. Essentially, this comparative method allows a full examination of how Gothic features have been transformed by present-day writers into collections of strategies that are applied to issues like environmental degradation. By making the allusions to the Gothic stories of the past, for instance, Mary Shelley's *Frankenstein* or Emily Bront's *Wuthering Heights*, the technique positions recent British climate fiction inside the broader literary panorama, on the one hand, the tradition is maintained and on the other, there is innovation.

Furthermore, mutual gravitation is accomplished and added by theoretical reviews on the author's works and new criticism for British climate fiction to differentiate single works in the mass of the whole literature's response to the environmental crisis. For the purpose of showing how these works present themselves in relation to other literary genres, secondary sources such as reviews, journal articles, and critical essays are necessary. Among these are *Ghost Wall* and *Sealed*, with proven valuation bias and ongoing debates, respectively. A synthesis that integrates textual analysis, with eco-critical perspectives and the historical trajectories of the Gothic theme, provides a useful mechanism in the study of climate fiction in Britain, in the sense that gothic techniques are utilized to accommodate the uncertainties and fears caused by a rapidly changing environment.

III. The dark landscape: climate crisis as gothic backdrop

In the setting of a place and the atmosphere, the current British climate fiction of the time usually depicts a dim and menacing landscape that acts as both the setting and the character embodying the ecological anxieties ornamenting the narrative. A pathway that leads from reality forming to mysticism, from the emotional decay to spread of dread. Thus, nature becomes an outlet for the Gothic craving for fantasies of creepy, barely possible scenarios. The ominous and oppressive settings in novels like *The Loney* by Andrew Michael Hurley and *Ghost Wall* by Sarah Moss which are awash with themes of environmental decay, show exactly how the land which is merely a symbol of nature is depicted to be vanishing. *Loney* is a good example since the stern, windswept coastline and the swampy, ghostly-clear marshes ambiently capture the mood of a story that is heavy with dread and mystery along the isolated and unforgiving terrain that cause the protagonists' emotional and spiritual tensions. In this way, though it may appear to be merely a background, the setting becomes an even more substantial element of the story, such atmospheric thrust being the most powerful amplifier of the point of alienation and misery that pervades the text. (Roberts, 2021: 45)

Nevertheless, it was the weather that was made Gothic one, thus, authors have turned the radiation of nature into forebodings that chill the readers and the tension has arisen to an unprecedented level. *Everything Under* by Daisy Johnson shows that the rising river and storms often happen which symbolizes the chaos and uncontrollable forces within the characters' lives. Nature is thus seen as a threatening, unpredictable entity. By drawing the weather as a character that commands the action in the plot, Johnson frames the environment as an active player in the narrative engagements that makes the reader be immersed in the story where the climate is a character that is very powerful and sometimes, terrifying. The setting becomes almost supernatural in the Gothic genre yet it is rooted in real-life environmental issues such as the fluctuations of the weather which are strongly connected to climate change and the ensuing ruin of the Earth, and thereby suspends to give nature an otherwise unfamiliar independence. Despite this fact, monochrome dawns over the British landscape of climate-fiction are traversed by symbolic ruins and decay which, in turn, add up the Gothic atmosphere and heighten the gloomy perspective the characters see the future. In *Ghost Wall*, Moss explains that the forest is too hot – suffocatingly still was the venue of re-enactment of generic Iron Age rituals - and thus it evokes the kind of atmosphere which make sure that both the reader and the characters remain tense. Through this, the forest is a place of suffocation because the boundary between humanity and nature becomes fuzzy, thus, it highlights the dangers of ecology upheaval. (Powell, 2020: 68)

These scenes, tinged with fear, make nature's hitherto glorified beauty become a thing to horrify and isolate the reader, thus, nature provides a reader with a place to examine often overlooked truths. In these stories, environmental catastrophes seem to be felt by the elements themselves which thus suffer along with the characters or even forces that torture them. In other words, when mother earth bans rains or burns skies, the technique used by the authors, in a way, is to make climate optionally redundant, embodied by cloudy skies, persistent drizzles, or terrifying heat.

IV. The reimagined Gothic hero in ecological ruin

In modern British climate fiction, characters are shown as the ones who are the center of their own uprising as they attempt to come out of the darkness suddenly only to be locked by the nature that becomes the nonhuman and tyrannical enemy of humans. The view of nature as the antagonist of humans is thus another image that is cited in Gothic romance too. It is, however, in the climate melancholia of the present that there is nature not only close in trees but it is now so close to us as to be a threatening, even physical thing that we can touch. In Andrew Michael Hurley's *The Loney*, the main character's association with the sinister and unexpected wetlands is made concrete in such a way as to give him the memory of how it is possible for nature to be merciless to humans. The background portrays a hidden danger and shows apparent history which starts to give a more coherent image of its dim nature, as if it were holding its own script that will write about the intruder who is lost in his own dreams. (Long, 2018: 102)

Therefore, readers can see and interpret the horrible environment that keeps bothering the protagonist; with the help of Hurley who displays the inconceivable power that erupts within the wrathful nature, instinctively and potently, these readers/engagements experience the same. Such a transition from supernatural horror to the horror of nature has not only been the protagonist's means of dealing with the experience but also the victim of an earth that is no longer home, who is not quite alive anymore but still looks on the good old days with nostalgia. While Gothic protagonists in climate fiction share the same fundamental characteristics with the traditional gothic hero, they have been tongue-in-cheek modified to depict the current state of affairs and the environment-in-crisis alike. (Price, 2020: 67)

The characters then are not haunted by their own inner devils or suffering from societal limitations but rather, are facing natures that wreak havoc on them and the world by their forced flight and insecurity. Alongside the sadness evoked by precisely cutting away the protagonist's whole domestic world comes the other already exists version of the one who is then ever more unseen due to the environmental degradation caused by floods of rising tides. Johnson's character isn't a Byronic hero who is using his desires for awesomeness; she is the modern-day archetype of a person who is suffering due to nature being an all-powerful force that she is absolutely powerless against. A hero who hence represents a paradox of taking the earth as an agency of the narrative. Moreover, the naturally evolved world compels the character to experience and subsequently the reader to endure evidence of the human-nature relationship construction on one level or another. Johnson's style toting and others comparing the Gothic hero with the environmental issue, the protagonists become in fact the humanity's double existence of the nature and the temporal and spatial environment that has only existed for the moment. (Stone, 2019: 55)

Additionally, these characters have an insight of a grim future which looks like the doom and gloomy-themes of the Gothic tradition. Then, in the context of *Ghost Wall* by Sarah Moss, a protagonist's visceral relation with the land becomes which is both a source of fascination and horror. Alongside this primitive re-enactment of her life, she is driven to the irrational thought that these natural elements act against her, with unbearable heat, impenetrable forests, and chilling quiet all playing psychological games with her. Therefore, Moss's protagonist is the new Gothic isolated hero who through his or her own experience conveys this course: the protagonist lives in a hostile milieu, where the distinction between the inward and the outward is blurred, and nature's insensitiveness causes him or her to never forget how fragile the human condition really is. The protagonist's feeling of loneliness is augmented by his connection to the destructive environment, which can be explained as if nature with its primitive, uncanny might hates human beings. These lonely and abandoned heroes, placed among the wreckage of an environment in ruin that would parallel the waste land, give a portrayal of the mental damage caused by a style of life in a world where nature is purely an opponent. On the contrary, nature, as a representation of all contingent dangers caused by climate change and environmental collapse, is becoming the absolutist adversary. Naomi Booth's *Sealed* is a wonderful illustration of how this protagonist deteriorates both physically and emotionally because the air she breathes is toxic, and the diseases around her are rampant creating for her a living nightmare. Gothic involved the descent to darkness of a hero, however, in Sealed the emotional blackness comes from the ecological destruction, which hurts humans, rather than through a personal fault or hidden knowledge. (Burnett, 2023: 94)

The story of the protagonist is a concise articulation of the social fears, with her pain symbolizing the powerless state of humanity against the ruthless nature. Through these Gothic style characters, which have been modified in the contemporary British climate fiction, the characters are not only concerned about their past but also about the future world, which might become a monster and swallow them, wherein the traditional Gothic archetypes are mixed with the urgent environmental themes on the verge of each other.

V. Themes of isolation and fear

In the contemporary climate fiction of Britain, themes of loneliness and fear are strongly intertwined, where the characters frequently find themselves alone in desolate landscapes that are the limit of human endurance and the disturbing power of nature is laid bare. Separation is not just a mere physical solitude but a deep impersonal alienation from the known world, as the characters face environments changed beyond recognition by the ecological crises. Andrew Michael

Hurley *The Loney* elegantly conveys this isolation of the characters as they meander the spooky, muddy coastline, where the mist envelopes the land and makes it uninhabitable, thus highlighting their parting from safety and civilization. The depiction of isolation in the wastelands creates an environment that is both endless and confining where survival becomes a struggle both inside and outside, therefore, highlighting the tenderness of human life no longer being able to exist in the world. In such narratives, the landscape is a prison that traps the characters in its hostile embrace, wherein any step forward results in only firmer isolation. (Allen, 2020: 76-77)

Through rising waters and erratic weather, the river becomes a mirror for the unsteady fears of the characters in Daisy Johnson's novel *Everything Under*. The river which is both a lifeline and a death trap is a force that the main characters cannot comprehend or control this creates an atmosphere where fear becomes the underneath movement. The overwhelming nature that unpredictably changes landscapes and overturns lives at any moment is the same kind of fear of the unknown that the Gothic narratives used before where the supernatural was the thing that surprised. But now the horror is caused by real ecological phenomena which bring a sense of dread to the natural world that mirrors mankind's great discomfort with environmental destruction. Fear and isolation in these climate narratives are intensified by the fact that nature becomes a hostile entity itself, which is not only passive but deliberately destructive. Sarah Moss's *Ghost Wall* encounters this idea as characters attempt immersive forest living, which eventually draws them to be subjected to the elements. The very high temperature and the oppressive silence in the forest make a very scary look. Thus, the characters feel more and more lonely and powerless. Besides, the omnipresence of nature works like a constant reminder of their own nothingness. The isolation is not only a physical but a psychological experience, as the characters are deprived of societal comforts and compelled to confront their fears in a setting that offers no respite. Moss a supernatural forest with its quietness and isolation becomes a Gothic landscape where the only way to save life is to deal with nature's sheer and unyielding power. (Greenfield, 2021: 164)

The authentic seclusion and steady fear that battery these stories are added with a knowledge of human fragility, as the protagonists find themselves in a situation where they are no longer the motor that makes the environment move but rather its drive. Naomi Booth's *Sealed* divulges the terrible moments of encountering unseen and unmatched danger, smoke, and toxins being released into the air, therefore, the characters ending up as a toxic, unlocked vessel is highly soared. In this case, the feeling of separation is not only limited to the far-off region covered with dust, but it is also in the air they inhale, which is the source of the knowledge that there are risks that have not been identified yet. The characters are lonely both physically and existentially, as they realize that nature can be this piercing invisible force that simply lies at home, therefore, making even the familiar seem odd and dangerous. (Hill, 2019: 132)

Booth's story is set in a nature that has been so changed that it is practically impossible to make a distinction between being alive and dying, so, loneliness is the main part of the existence of the changed-the-environment. In these gothic stories of today, the themes of remoteness and fear have been the main pillars of climate fiction in Britain, which also incorporates the older elements like gloomy halls and scary atmospheres blending with environmental issues. The individuality of the characters in these dangerous settings emphasizes the vulnerability of the humans in this time of environmental changes where fear is both a powerful constraint of nature and the pain of humanity's declining position. These stories throw a very strong vulnerability into the characters' meeting with the environment that is not only a passive stage but turns into an active and occasionally antagonistic force that twists lives, and the only things left are negative fear and loneliness. (Martin, 2021: 88)

VI. Allegorical monsters: nature's wrath personified

In the British climate fiction of today, the Gothic symbolism and allegories are enlisted to express ecological despair, with elements of nature presented in the form of frightening, layered images that speak of human neglect and fear of environmental degradation. As the narrative vehicle, this idea moves outside the boundary of simple description into the superimposition of meaning on the places that are personal as well as common concerns about ecological destruction. Sarah Moss and Naomi Booth use the Gothic symbols of darkness, decay, and wilderness to hint at the nature's becoming unfriendly, thus it passes from being a rather nurturing one to such which is practically dangerous, threatening, and suffocating. In her *Ghost Wall*, the claustrophobic forest that Moss describes is a metaphor for the way humanity has wronged nature, likening the suffocating trees and thick undergrowth to the characters' mental imprisonment and the lack of escape from a seemingly outsmarting piece of nature. It is in this way that the forest becomes a symbol of Gothic, influenced by the external decay process that is an embodiment of environmental pessimism of today's life. These allegorical monsters in these texts serve as metaphors for the environment's angry reaction which is in turn an outlet in the otherwise formless and overwhelming social forces of climate change and environmental degradation. Naomi Booth's *Sealed*, pollution and diseases get symbolically depicted as creatures that are the evil, insidious threats, which are given more credence by making such everyday things as air and water to die a death through those vectors. (Daniels, 2020: 22)

The shift from fantasy monsters to the real effects of humanity's intervention with nature through the use of clichés such as toxins and contaminants is a move away from the inspired notion of a creature gone bad towards the victims of pollution in the shadows. Booth's work reimagines the Gothic monster, not as an animal-like character, but as the very air we are entering, uploaded by human activity and now it becomes forceful, scaring the residents who must live within its very vicinity. Thus, the nature's wrath is not bluster, but

it is something within man himself, and hence the ecological destruction that befalls is allegorized into having smeared each aspect of life with pollutants and their accompanying danger of pollution. (Ford, 2020: 234)

Environmental destruction is often linked to the Gothic of decay when locations and objects evolve into lonely, degraded scenes that allow for creating the image of a weakening environment. Andrew Michael Hurley's *The Loney*, the clandestine bogs, and without care buildings are the main two symbols showing the lack of human interaction with the area and the degradation of nature that made it possible for the plant to break through. The landscape thus becomes a metaphor for that patient behaviour, under which every broken building and irregular wild path are clear testimonials of the discrepancy between human interference and nature. Consequently, through those symbols, Hurley designs a landscape that is both sinister and accusatory, thus serving as a physical manifestation of the results of the fact that no longer a wilderness but a devourer. The wrath of nature is also represented with the depiction of natural forces as carriers of bad news, so the symbolism of Gothic is shown and the transformation of everyday things into the sources of fear and wonder is achieved. (Harris, 2018: 46)

In Daisy Johnson's *Everything Under* the river, on the one hand, is the life-giving and, on the other hand, the destruction-creating force. Despite the fact that the killer water surface is a wonderful device for unearthing the protagonists' earthly reflections when it continues to rise, the dual symbolism of the river can be kept inside this river. The river of meanings, to give life, to threaten life, to be calm, or to be turbulent, highlights the unpredictability of climate change, wherein nature does not anymore, so to say, keep the balance of fragility of the greedy human beings. Johnson's river, a wise force, which brings nature, both provider and taker, to the Gothic story that seems to be both the trigger for the protagonist and a memento that they are subject to the power beyond their control. Thereby, writers in Britain's climate fiction movement use Gothic symbolism in such ways that both places and characters are *haunted* by environmental damage, thus nature being an eternal metaphor and a symbol of a seemingly inescapable recourse. (Walker, 2020: 33)

Environmental awareness is the core thing through motifs and metaphors in these novels of the new British climate fic that show nature to be a reactive and an extremely angry agent, thus representative for the vividly depicted world which is so horrifying and terrifying to the humans. The creeping buildings, highly toxic air, and the personified waters were the initial catalysts to play this concert, thus raising the point of the fact that our actions are causing irreparable damage to the environment. Moreover, the readers are also shown the sad truth of a constantly degrading environment that humans cause. Through this treatment of Gothic symbolism and metaphor, the story assumes a dual role as it acts both as a narration tool and a profound commentary on the relations between members of the species and Nature; showing the era in which Nature is both the antagonist and the victim in the mutual, fragile forms. (Grossman, 2017: 76)

Conclusion

British climate fiction that has the Gothic themes interspersed in it closely resembles the separate literary genre which through captivating references to some of the strict problems of society talks of the fears that it causes. By books like *The Loney* by Andrew Michael Hurley's, Daisy Johnson's *Everything Under*, and Naomi Booth's *Sealed*, today's writers are conveying the message that the environmental threats are creepily being absorbed in the natural geography we are familiar with. They are the places that are the sources of such fear as well as of self-exploration. In fact, the uniqueness of the genre is its aesthetic creation of spectral sites along with alienation and the grotesque interconnectedness of climate change which not only evokes readers' immediate reactions about the Earth's future but also connects with their inner existential thoughts. The places in the novels are represented not only by locations but also by psychological connections that are hidden under the surface of the phenomenon of climate change which is irreversible. Besides that, British climate fiction, which in its turn, is inspired by the Gothic themes, not only provides a new impetus to this kind of literature but also keeps its old essence by addressing everyday ecological problems of the people.

This line of literary development embodies not only a growing environmental awareness but also represents the way the human and environment interaction is turned into a qualitative one. By reinventing the Gothic approach, the authors induce the reader to feel the tension between the thought of environmental failure and the more subtle issues of manipulation of natural resources and overexertion. Gothic storytelling is becoming a narrative technique hybrid in which supernatural and unnatural elements are employed as metaphors to conjure up the unpredictability of the current state of affairs when nature becomes both a danger and a wonder in itself. These are the narratives that draw attention to the significance of the environment together with show how the commonness of the situation is mirrored in the similarity of the forces of destruction that torment the characters in the novels, which, in turn, could become a reality for us if we persist in following the same direction. Climate fiction in the UK is very much about its textures, which unfold the physical destruction of nature, but they also should reflect the psychological side of these social changes. An example of Sarah Moss's *Ghost Wall* shows how the forest that is full and alone is a metaphor for the estrangement of both nature and people. It further shows that the ecological damage only aggravates the social one.

Diverse forms of the Gothic narrative, including the shift to mindset topics, are giving the authors the freedom to engage with some other climate change aspects as well as to emit environmental demarcations into the moral and cultural dimensions. Narrated through characters who are suffering the impact of climate changes that are becoming more severe over time, the texts bring the prospect for readers to imagine through the stories the possible psychological impact of living on an Earth that is increasingly harsh and turbulent.

As a motion picture of societal fears, the responsibility, legacy and ethical action in British climate fiction also come into the arena, where the Gothic scepticism of the reckless human ambition and exploit, is echoed. Naomi Booth's *Sealed* delves into the detrimental hazards of the environmental degradation, which the people have to bear in their lives due to the pollution and the contamination. Creating nature that has been changed into a nearly monstrous entity is one such narrative that helps the readers rethink their relations with the planet and thus, not only analyse what has been lost but the plights that are still available to be addressed. A contemplation of this kind elevates the genre's potential to be a dynamic tool for social change, as the artistic works spur the spectators to learn the vast interrelationship among the personal, cultural and eco-social welfare.

The climate gothic will in the future likely keep thriving and adapting to the global change as authors address the increasing climate crises and their widespread consequences. As one of them, British climate fiction will last a long time as a highly relevant genre that combines the supernatural and environmental awareness, with the utilization of Gothic symbolism to highlight the destruction of nature. The readers through these narratives, have an encounter of the various fears of a world that is dynamic, hence, by such stories, they get filled with awe and they get provoked.

The potential for the genre to show societal fears along with a demand for ecological consciousness is its primary factor for continuously being relevant, and it makes the expressions of the Gothic elements and their meaning in the very context of environmental disaster. The continuing success of this technique of writing suggests that climate fiction, which is imbued with the Gothic, shall stay a strong instrument for the psychological and cultural narration of humanity's most serious existential problem, the need to repair its relationship with the environment.

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EDUCATIONAL ISSUES IN THE CREATION OF MUHAMMAD FUZULI

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Abstract

Education and scientific-artistic issues occupy a special place in the work of Muhammad Fuzuli, one of the caliphate artists of medieval Azerbaijani literature, a great master of words, who created works greater than words. The great artist has revealed his stylistic skill by approaching these issues from the general view of the Turkish people with Eastern morality and culture. In the article, these issues that are the basis for Fuzuli's creativity are touched upon, and the issues that have a positive effect on the spiritual world and scientific worldview of young people are discussed. The pure deeds of man, which constitute the main content of Fuzuli's creativity, have always been at the forefront. In the Fuzuli world, humanism and human qualities originate from the Fuzuli philosophy.

The essence of humanism and the perfect human philosophy, which is the basis of Fuzuli's creativity, and its role in educational moments have been investigated. According to the poet, a person can rise to this height with his scientific and high moral qualities. These issues have been widely explored in the poet's work.

Keywords: Azerbaijani literature, upbringing, education, culture, love, work, genre, ghazal

Muhammad Fuzuli is one of the artists who have provided exceptional services to the development of Azerbaijani literature. His creativity is the most valuable spiritual wealth of world culture. The works of the great wordsmith have been a source of inspiration for writing artistic works in many world literatures. In particular, "Divan", which he created in his native language, had a strong influence on the literature of the Turkic peoples. By combining the possibilities of the epic genre with the lyrical genre, he had an important impact on the development of literary thought. In order to express the endless pain and sorrow of ordinary people, Fuzuli turned every word and every verse into a symbol of wisdom and wisdom, and created examples of poetry that have preserved their spiritual value for all times. His poems are a symbol of intelligence and wisdom, an example of figurative thinking and artistic logic.

This year, that is, in 2024, the 530th anniversary of the birth of the contemplative artist Muhammad Fuzuli will be completed. Like other artists, attention and care to Mohammad Fuzuli has always been at a high level. Mr. President Ilham Aliyev, who is loyal to the traditions started by our national leader, signed a decree on January 25, 2024 on the celebration of the 530th anniversary of the birth of Muhammad Fuzuli. The art of Fuzuli is a hearth that takes fire from the language and intelligence of the people and spreads flames, and burns brighter from time to time with the heat of high and holy emotions that have been growing in the human heart for thousands of years [9. p. 25].

All this suggests that Muhammad Fuzuli is a genius wordsmith who has deep roots in Azerbaijani literature, culture and world literature. All genres of classical literature can be seen in the works of Mohammad Fuzuli. Especially, Fuzuli's ghazals glorifying love conquer the hearts of readers. In these ghazals, the tender feelings of a pure, pure heart are expressed. A genius artist by the power of words inspires people to think and dominate their spiritual world.

In his works, love and morality, education and science develop in parallel. Viewing life from the world of Fuzuli is a method of education, because in his works sincere emotions and real life are expressed so fluently that the power of Fuzuli's intelligence speaks for itself in these works. In his lyrics, folk wisdom and folk love are prominently branched out. In his epic works, one can master the depth of sciences and the secrets of sciences. In the works of Mohammad Fuzuli, the issue of education shows itself prominently. In order to solve these problems, the poet moves allegorical images, penetrates into the issues of life, puts forward important scientific-philosophical, didactic-counseling ideas, that is, by bringing the spiritual and moral qualities of the generation to the fore, he forms his unique aspects. The works of the genius master of words play a very important role in the education of readers.

In each of M. Fuzuli's works, the issues of education and training show themselves prominently. In particular, many types of education prevail in his allegorical works. The basis of the poet's philosophical work is that everything that exists in the world is connected to moral values. The foundation of this morality comes from education and science. According to the artistic and philosophical thought of Muhammad Fuzuli, a person should always be the master and creator of his art. His work "Rindu Zahid" talks about acquiring knowledge, paying attention to good and bad habits in the world, and the role of scientific knowledge about the world. The main idea of the work is the meeting between Zahid father and Rind son, the father's training and admonition to his son, and more precisely, the father's advice to his son, which he knows to be true according to his time.

One of the most important aspects of the work is the prominent promotion of the call to learn knowledge and live hard. With his work Rindü Zahid, the thinker has created an interesting work that reflects his humanistic thoughts about life and people. He suggested in his lyrical works that education and upbringing play an important role in the formation of a person.

Muhammad Fuzuli described the social and political issues of his time in an original way with the work "Bangü Bade", which he wrote in his youth, and touched on social and moral issues in the person of two great rulers. The poem artistically revives the bitter consequences of wars. The events that took place in the assembly of Baden and Bang cause panics and wars.

In the work, the assembly of both Bang and Bade affects people's spirituality. However, unlike Bade,

Bangin's assembly consists of science, poetry and wisdom. Despite this, distrust and immorality prevail in the palaces of both rulers. Both rulers have become prisoners of their feelings. Bade and Bang, who cannot control their feelings, meet. These characters - Bade and Bang - who expose each other's faults, show that drunkenness and dependence on opium will bring great tragedies to human life. With his work "Bangü-Bade", the poet raises issues that protect the moral and spiritual feelings of the new generations and wants to see their future life bright by positively influencing the education of young people.

The great artist revived the social shortcomings he saw in his time in the work "Sohbat ul-asmar". He touched on the futility of unnecessary bragging. In fact, he touched on the social issues of his time in the argument of the fruits, who set themselves on fire by pointing out each other's faults. The poet's work "Sohbat ul-asmar" seems like a simple work at first glance, but it attracts attention with its advice. The allegorical work "Sohbat ul-asmar" is also among the pearls of children's literature. At the same time, this work has a positive effect on the moral and spiritual world of children. Muhammad Fuzuli expressed what he wanted to say and his admirable thoughts in the language of fruits. This work, which is simply interesting, also reflects deep philosophical thoughts.

The great thinker's work "Rindu-zahid" also attracts attention from the point of view of young people's acquisition of science and education, as well as educational issues. The focus has always been on education and learning of young generations. The work "Rindu-zahid" is completely dedicated to these issues. In the work "Rindu-zahid", there are several issues that are important even today and play a key role in human education and personality formation. Today, the influence of the social environment, which plays a major role in the education of young people, is great. In this work of Mohammad Fuzuli, those issues are realistically described.

Don't accumulate too much wealth,
Be prepared to hate your pain. [8. p. 55].

The futility of indulging in worldly goods is poeticized. Every verse of the genius artist suggests that the poet's world of science and morality is a synthesis. He mastered the secrets of many sciences and revealed his scientific potential. Even today, when you read his works again and again, you face a new science. In many cases, Fuzuli is focused on the social-philosophical meaning and purpose of life, on the spirituality of a person.

The works written and created by Muhammad Fuzuli will educate and prepare future generations in the spirit of loyalty to their people, land and most importantly, their homeland.

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PHYSICAL SCIENCES

EXISTENCE OF OTHER MUTUALLY INVISIBLE UNIVERSES ADJACENT TO OUR VISIBLE UNIVERSE CAN BE EXPERIMENTALLY PROVEN BY ASTRONOMICAL OBSERVATIONS IN THE PORTALS OF CONSTELLATIONS INVISIBLE OUTSIDE THE PORTALS[1]

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Abstract

The article explains that the special theory of relativity (SRT), created in the early twentieth century, which is an outstanding scientific achievement, was ahead of its time, because in physics at that time lacked some knowledge necessary for its creation – physical reality of imaginary numbers was not proved and the its physical meaning was not explained, dark matter and dark energy were not discovered, discrete mathematics and hyper-complex numbers were not used, and WMAP and Planck space-crafts were not launched into space yet. Therefore absence of the mentioned knowledge was justifiably replaced by postulates. But not everything was guessed. And present now in the version of SRT studied in all physics textbooks, the postulate called the principle of non-exceeding the speed of light turned out to be incorrect. Therefore the corrected version of SRT in which this postulate is replaced by the experimentally proved principle of physical reality of imaginary numbers is offered. In this corrected version of SRT also offered a experimental proof of the existence of mutually invisible parallel universes astronomical observations in portals invisible outside the portals of constellations. And it is explained, why the principle of non-exceeding of speed of light not disproved so far by physical experiments is incorrect. And why the incorrect version of SRT, studied in all physics textbooks, is still in demand.

Keywords: special theory of relativity, principle of non-exceeding the speed of light, principle of physical reality of imaginary numbers, relativistic formulas, dark matter, dark energy, universes, anti-universes, Multiverse, portals, anomalous zones.

1.Introduction

In the 20th century, physics, having changed the thousand-year-old tradition of creating theories on the basis of reliable experiments, began to call hypotheses that were interesting but not experimentally confirmed theories, including the special theory of relativity (SRT).

But what's even worse is that as a result of the struggle for survival, SRT was canonized - in the community of relativistic physicists and in public opinion, a conviction was formed about its infallibility, about the inadmissibility of its criticism and any subsequent corrections. Therefore, for example, in the USSR it was forbidden to criticize the SRT even three times - in 1934 by the decree of the Central Committee of the All-Union Communist Party (Bolsheviks) on the discussion of relativism, in 1942 by the decree of the Presidium of the Academy of Sciences of the Soviet Union on the theory of relativity and in 1964 by a secret decree of the Presidium of the Academy of Sciences of the Soviet Union, which prohibited any criticism of Albert Einstein's theory. And reviewers of some good journals have now started writing in their reviews *"I will not allow criticism of Einstein"*.

Unfortunately, the ban on criticism of scientific theories is not a new phenomenon. For example, Nikolai Copernicus, who spent 40 years in the 16th century creating the heliocentric system of the world, wisely published his theory *"On the Revolutions of the Celestial Spheres*", which refuted the geocentric system of the world of Claudius Ptolemy after his own death, not wanting to end up in the Inquisition. And Giordano Bruno and Galileo Galilei, who carelessly supported Copernicus' theory, had to deal with the Inquisition. Giordano Bruno was even burned alive at the stake. Therefore, the corresponding to common sense process of creating scientific theories by identifying in them as a result of experimental studies of certain shortcomings and their subsequent correction was not always smooth.

And although created in the early XX century by Joseph Larmor [1], Nobel Prize winner Hendrik Antoon Lorenz [2], Jules Henri Poincaré [3], Nobel Prize winner Albert Einstein [4] and other outstanding scientists STR [5]-[7], rightly recognized as a great scientific achievement, due to the lack of the necessary experimental knowledge at that time, which was forced to be replaced by postulates, as it turned out in the 21st century, nevertheless turned out to be incorrect [8]-[48], because:

- its relativistic formulas were incorrect;
- the relativistic formulas obtained in it were incorrectly explained using the incorrect principle of non-exceeding the speed of light;
- from these incorrect relativistic formulas were made incorrect conclusions about physical unreality of imaginary numbers discovered 400 years before the

[1] This is reprint of the article "Antonov A. A. Experimental Evidence for the Existence of Other Mutually Invisible Universes Neighboring Our Visible Universe. European Journal of Applied Sciences. Services for Science and Education. United Kingdom. Vol. 12 No 5. DOI: 10.14738 /aivp.125.17785"

creation of SRT and about the existence in nature of our only visible universe, in which everything is measured only by real numbers.

However, it continues to be studied all over the world today uncorrected in all educational institutions, even the most prestigious ones.

2. Unsuccessful refutations of the version of the special theory of relativity presented in all physics textbooks

Why? Let's figure out why it happened this way. The relativistic formulas obtained by the creators of STR:

$$\boldsymbol{m = m_0 / \sqrt{1 - (\frac{v}{c})]^2}} \quad (1)$$

$$\boldsymbol{\Delta t = \Delta t_0 \sqrt{1 - \left(\frac{v}{c}\right)^2}} \quad (2)$$

$$\boldsymbol{l = l_0 \sqrt{1 - (\frac{v}{c})]^2}} \quad (3)$$

in which m_0 – rest mass of a moving body;

m – relativistic mass of a moving body;

Δt_0 – rest time of a moving body;

Δt – relativistic time of a moving body;

l_0 – rest length of a moving body;

l – relativistic length of a moving body;

v – speed of motion of a body;

c – speed of light;

were explainable only in the range of subluminal speeds $v < c$, in which the quantities m, Δt and $\boldsymbol{l}$ took on values measured by real numbers. But in the range of superluminal speeds $\boldsymbol{v > c}$ these quantities m, Δt and $\boldsymbol{l}$ already took on values measured by imaginary numbers discovered by Scipione Del Ferro, Niccolò Fontana Tartaglia, Gerolamo Cardano, Lodovico Ferrari and Rafael Bombelli [49] 400 years before the creation of the STR, the physical meaning of which, however, was not explained by them. But, perhaps, even earlier than them, imaginary numbers were discovered by Paolo Valmes [50], who for this was burned alive at the stake by the sentence of the mercilessly cruel inquisitor Thomas de Torquemada. Even Isaac Newton[2], in order to avoid trouble, preferred not to use imaginary numbers at that time. The creators of the STR also did not know how to explain them. And the physical meaning of imaginary numbers in physics textbooks has not been explained to this day. Moreover, the graph of the function $\boldsymbol{m(v)}$ in the range of velocities $\boldsymbol{v > c}$ (see Fig. 1a) corresponds to a physically unstable process that cannot exist in nature at all.

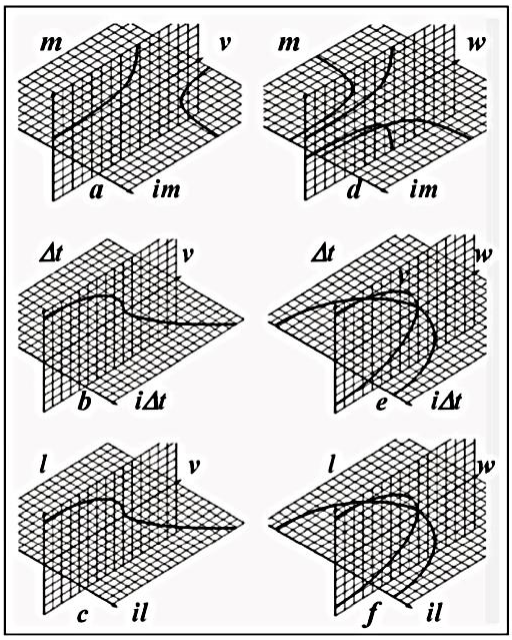


Fig. 1. Graphs of functions $m(v)$, $\Delta t(v)$ and $l(v)$ corresponding to the existing and the corrected versions of the STR in the subluminal $\boldsymbol{v < c}$ and superluminal $v > c$ ranges

But such a theory, which even its creators could not explain, was naturally of no use to anyone. And therefore, at that time, a postulate called the principle of not exceeding the speed of light was justifiably introduced into the STR, the essence of which is clear from its name. And according to this postulate, formulas (1)-(3) in the range of speeds $\boldsymbol{v > c}$ no longer needed to be explained, since the functions $\boldsymbol{m(v)}$, $\boldsymbol{\Delta t(v)}$, $\boldsymbol{l(v)}$ allegedly do not correspond to any existing processes in nature in this range. And this was very close to the truth. In any case, at the time this postulate appeared in the STR, such processes were unknown on earth.

Therefore, from formulas (1)-(3) it was quite logical to conclude that imaginary numbers are physically

[2] And his friend William Whitson, in an atmosphere of the omnipotence of the Inquisition, was stripped of his professorship and expelled from Oxford University for some of his careless statements.

unreal and that in nature there is only one visible universe. And in this form STR is still presented in all physics textbooks.

But in 1934, Pavel Alekseevich Cherenkov discovered a process called Cherenkov radiation [51], which refuted the version of STR presented in physics textbooks, since it was explained by the movement of electrically charged particles in a transparent medium with a refractive index $n > 1$ at a speed exceeding the phase velocity of light in this medium. For this discovery P. A. Cherenkov, I. E. Tamm and I. M. Frank even received the Nobel Prize in 1958. Nevertheless, STR withstood, specifying that the principle of not exceeding the speed of light refers to the speed of light only in a vacuum, i.e. in an optical medium with a refractive index $n = 1$.

The next attempt to refute the textbook version of STR was undertaken by the widely publicized OPERA experiment [52] at the Large Hadron Collider in 2011, in which approximately 200 physicists from 36 institutes in 13 countries took part. The goal of the experiment was to detect superluminal neutrinos, and thereby refute the principle of not exceeding the speed of light and the generally accepted version of STR. For which the performers of this experiment expected to receive the Nobel Prize. And on September 23, 2011, an article by the OPERA collaboration appeared in the archive of electronic preprints, in which it was reported that such superluminal neutrinos had been detected by them. However, on March 15, 2012, a message was published about the ICARUS experiment [53] conducted at the same Large Hadron Collider, which refuted the OPERA experiment.

And that's it. No one other than the author[3] of this article has offered any other physical refutations of the corrected principle of not exceeding the speed of light.

3. Successful refutation of the version of special theory of relativity presented in physics textbooks

So why then is it stated above that the version of the special theory of relativity presented in physics textbooks is incorrect?

Because there are other sciences besides physics. Including electrical engineering and radio engineering, which appeared before the STR, and whose very existence proves the physical reality of imaginary numbers and thereby refutes the version of the STR presented in physics textbooks.

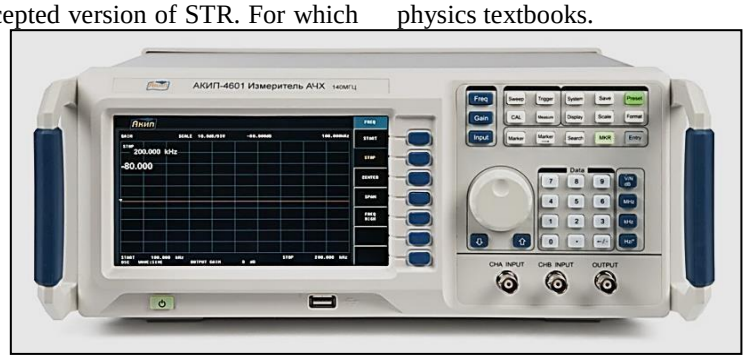


Fig. 2. In any radio-technical laboratory there are devices called frequency response meters, which prove the physical reality of imaginary and complex numbers by their mere existence

Indeed, in electrical engineering and radio engineering, the Ohm's law, as interpreted by Steinmetz [54], discovered in 1893, is fundamental. It is now used daily in practical work by millions of electrical and radio engineers all over the world. Thus, naturally, confirming that it is true. And according to this law, in linear electrical circuits of alternating current, the electrical resistances of capacitors and inductors (also called inductors) are measured by imaginary numbers of different polarities, and only the resistances of resistors are measured by real numbers. Note that the previous phrase states that the imaginary resistances of capacitors and inductors are measured. And indeed, in all electrical and radio engineering laboratories there are many devices (for example, see Fig. 1) that measure the imaginary parameters of electrical circuits. Even every radio amateur has such a simple device, called a tester.

And everything that is measured really physically exists. Physicists know this very well. And this is a fundamental position of any science. If people did not use devices in their activities, but relied on knowledge obtained only from their senses, then science would not exist. And since in electrical and radio engineering the resistances of capacitors and inductors, once called imaginary, are in fact measured by existing devices, then they are not imaginary at all, but the most real physically existing. And the author of this article wrote about this back in 2008-2010 [55]-[59], i.e. before the publication of the results of the OPERA experiment, making it unnecessary. But the OPERA collaboration ignored these publications and carried out its own very expensive, but unsuccessful experiment. Relativistic physicists still ignore subsequent, including other, proofs of the principle of physical reality of imaginary numbers [60]-[66]. According to which the SRT is refuted by the existence of bell ringing, tsunamis and even suspended swings on playgrounds. Since it follows from the generally accepted version of the SRT that they should not be there. That is, the swing should not swing after a push from parents. But you know that they swing.

Nevertheless, these publications prove in the most indisputable way that the named imaginary numbers, contrary to the postulate of the STR about not exceeding the speed of light, are physically real not only in electrical and radio engineering, but always and everywhere in all sciences. And therefore it is time to realize that mathematics cannot be one for Einstein, another for

[3] See below for more information on them.

Steinmetz, and a third for someone else. Therefore, imaginary numbers are physically real in all sciences. Including physics. And textbooks on different sciences (primarily physics textbooks and radio engineering textbooks) should not contradict each other.

And since the statement following from the postulate of not exceeding the speed of light of the STR about the physical unreality of imaginary numbers turned out to be incorrect, it is obvious that this postulate itself is also incorrect. And therefore the generally accepted version of the STR itself is also incorrect [8]-[48].

And no experiments are ever refuted by postulates.

But how then can we explain the existence in physics of the physically unrefuted principle of not exceeding the speed of light?

4. Correction of relativistic formulas of STR taking into account the experimentally proven principle of physical reality of imaginary numbers

So, we need to think some more.

Since, as has just been proven, imaginary numbers are physically real, the relativistic formulas of STR, taking this circumstance into account, must be explained. And for this, first of all, they must be corrected so that they correspond to physically realizable processes. For this, the relativistic formulas (1)-(3) in the ranges $-\infty \le v < 0$ and $c \le v < +\infty$ must be such that the graphs of the functions ***m(v), Δt(v), l(v)*** (Fig. 1d,e,f) are similar to the graphs of the same functions ***m(v), Δt(v), l(v)*** (Fig. 1a,b,c) in the range $0 \le v < c$, i.e. have the form

$$m(q) = m_0 i_1^q / \sqrt{1 - (\frac{v}{c} - q)^2} \quad (4)$$

$$\Delta t(q) = \Delta t_0 i_1^q \sqrt{1 - (\frac{v}{c} - q)^2} \quad (5)$$

$$l(q) = l_0 i_1^q \sqrt{1 - (\frac{v}{c} - q)^2} \quad (6)$$

where $q(v) = \lfloor v/c \rfloor$ is the "floor" function of discrete mathematics of the argument v/c (its graph is shown in Fig. 3a), which is the fourth spatial dimension;

$w(v) = v - qc$ is the local velocity for each universe (its graph is shown in Fig. 3b).

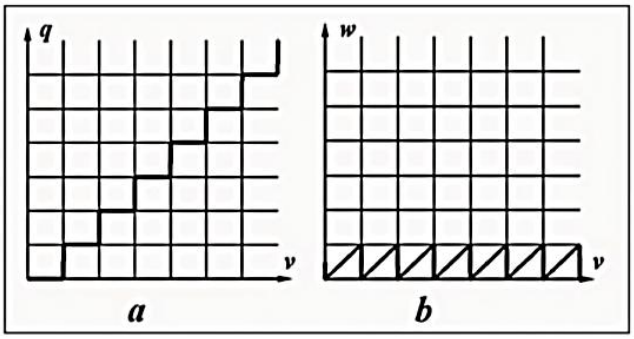


Fig. 3. Graphs of the functions q(v) and w(v), illustrating the meaning of the "floor" function of discrete mathematics

Moreover, this function i^q in formulas (4)-(6), defining the essence of each universe, for successive values of ***q(v)*** equal to ***0,1,2,3,4,5***,... , takes values ***+1,+i,-1,-i,+1,+i***, ... And the value ***q(v)=0*** in formulas (1)-(3) for the range of speeds $V < C$ corresponds to our visible universe, which for definiteness we will call the tardion universe. To the value ***q(v)=1*** in the superluminal velocity range corresponds some other invisible universe, since it is beyond the event horizon. For definiteness, therefore, we will call it the tachyon universe. The value ***q(v)=2*** will then correspond to the invisible tardion antiuniverse, the value ***q(v)=3*** will correspond to the invisible tachyon antiuniverse, the value ***q(v)=4*** will correspond to another (and therefore already invisible) tardion universe, the value ***q(v)=5*** will correspond to another tachyon universe. And so on.

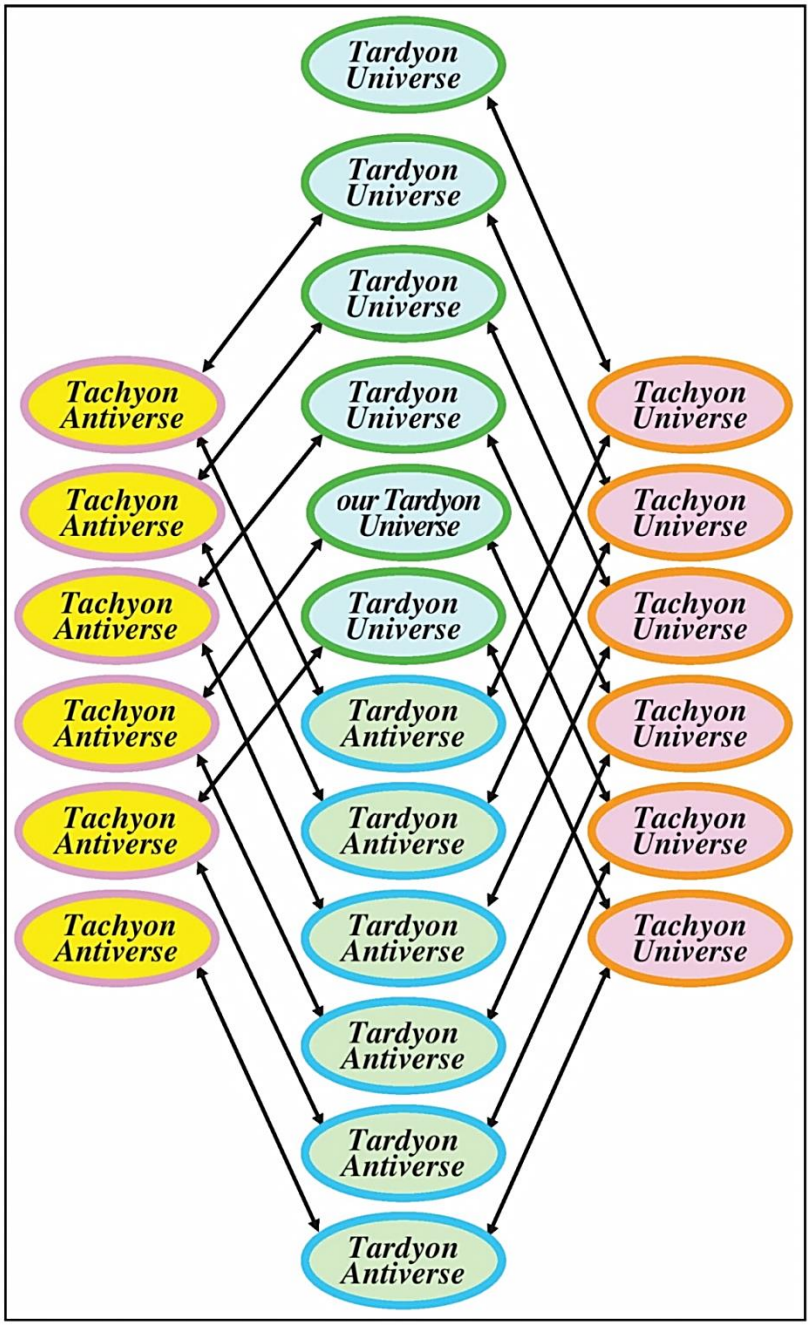


Fig. 4. Structure of the hidden Multiverse corresponding to the principle of physical reality of complex numbers

I.e. according to formulas (4)-(6) there is not one universe in Nature, as it is stated in the generally recognized version of SRT, but a set of mutually invisible universes forming the Multiverse, which therefore we will call hidden. Such a hidden Multiverse, the structure of which is helical, is given in Fig. 4. And in this structure of the hidden Multiverse the distribution of material contents in each three-dimensional parallel universe will be determined by its function $f_q(x,y,z)$, and the value q is the coordinates of these universes. I.e. the hidden Multiverse will be described by the formula $f_q(x,y,z) + iq$.

And this structure of the hidden Multiverse already allows us to explain the problem - where antimatter is located [67]-[71], which is inexplicable within the framework of SRT studied in all physics textbooks. It is clear that it cannot be in our visible universe, because due to its annihilation with matter our universe would cease to exist. But the fact that antimatter still exists has been proven experimentally. In 1995 at CERN a sensational result was obtained - scientists managed to get nine atoms of antihydrogen, which existed for about forty billionths of a second. And just one gram of such antihydrogen would cost 662.5 trillion (i.e., a thousand billion) dollars.

In the structure of the hidden Multiverse shown in Fig. 4, antimatter (in relation to our earthly matter) is in the nearest tardion antiuniverse [72], which is the cosmic antipode of our visible tardion universe. Moreover, in this tardion antiuniverse there also exists anti-time and anti-space [73]-[82]. But if an inhabitant of the Earth got into the tardionic antiverse, he would not notice anything unusual, as antipodeans do not notice it on the Earth.

Such structure of the hidden Multiverse also allows, at last, to explain the problem that has been tormenting us for a long time - how to reconcile the experimentally proven principle of physical reality of imaginary numbers and the supposedly experimentally irrefutable principle of non-exceeding of the speed of light (because of which the wrong version of SRT, presented in all physics textbooks, is still in demand)? And it turns out that everything is explained very simply and clearly. The statement about existence in the nature only our visible universe follows from the refined principle of non-excess of speed of light And the refined principle of non-excess of speed of light of SRT follows from the statement about existence in the nature only our visible universe. But that's self-deception that proves nothing! In fact, the refined principle of the unexceeded speed of light, irrefutable in the generally recognized version of SRT, is refuted by the existence of other mutually invisible tardion and tachyon universes and antiverse within the hidden Multiverse, since for all of them $v > c$.

And in order to learn something else about the hidden Multiverse, additional experimental knowledge is already needed.

5. Correction of relativistic formulas using experimental data obtained by WMAP and Planck spacecrafts

And as such additional experimental data we will use the data obtained by the WMAP and Planck spacecrafts, although they were launched into space with a different purpose - to study dark matter and dark energy.

The WMAP spacecraft [83] was launched by the National Aeronautics and Space Ad-ministration (NASA) in 2001, and it operated until 2010. And Planck spacecraft [84], launched by European Space Agency (ESA) in 2009, operated until 2013. And according to the data obtained by the WMAP spacecraft, the entire Universe (in fact, of course, the entire hidden Multiverse) consists of 4.6% baryonic matter, 22.4% dark matter and 73.0% dark energy. And according to more recent data obtained by the Planck spacecraft, the entire universe (again, in fact, the entire hidden Multiverse) is 4.9% baryonic matter, 26.8% dark matter and 68.3% dark energy. But what dark matter and dark energy are themselves, was not explained.

And since it was proved above in the most indisputable way that there is not a mono-universe but a hidden Multiverse in Nature, dark matter and dark energy should now be explained in the hidden Multiverse [85]-[89]. In this case it is quite logical to assume that these phenomena are somehow generated by the very structure of the hidden Multiverse and are caused by mutual influence of invisible parallel universes on each other. And then the main features of these phenomena - their invisibility and undetectability of their corpuscular contents - which have been unexplained so far, can be explained clearly and convincingly:

- dark matter and dark energy are in fact not any material physical entities, but only phenomena (presumably gravitational shadow) generated by the existence, besides our visible tardion universe, by other invisible parallel universes and antiverse of the hidden Multiverse;
- dark matter is a phenomenon generated by the existence of invisible parallel universes of the hidden Multiverse neighboring our visible universe;
- dark energy is a phenomenon generated by the existence of other invisible parallel universes of the hidden Multiverse besides our visible universe and its neighboring invisible universes;
- and precisely because dark matter and dark energy are merely phenomena, they have no material content[4].

Therefore, attempts to detect some subatomic particles of dark matter and dark energy by the current research at the Large Hadron Collider are probably of little promise.

Such an explanation of these phenomena also allows us to clarify the structure of the hidden Multiverse. Indeed, assuming, in accordance with the law of communicating vessels, that the mass of different invisible parallel universes in the hidden Multiverse is almost identical with a high degree of accuracy due to the presence of a large number of portals between them that have existed for billions of years, it is possible to determine:

- how many parallel universes form the hidden Multiverse. And according to the above data obtained by the WMAP spacecraft, their number is 100% / 4.6% = 21.74. And according to the data obtained by the Planck spacecraft, their number is 100% / 4.9% = = 20.41. Therefore, their real number is presumably 20 ... 22 parallel universes.
- how many parallel universes are neighboring our universe and give rise to the phenomenon of dark matter. According to the data obtained by the WMAP spacecraft, their number is 22.4% / 4.6% = 4.87. And according to the data obtained by the Planck spacecraft, their number is 26.8% / 4.9% = 5.47. Therefore, their real number is most likely 5 ... 6 parallel universes.
- how many parallel universes generate the phenomenon of dark energy. And according to the data obtained by the WMAP spacecraft, their number is 73.0% / 4.6% = 15.87. And according to the data obtained by the Planck spacecraft, their number is 68.3% / 4.9% = =13.94. Therefore, their real number is presumably 14...16 parallel universes.

And as can be seen, the experimental data obtained by the WMAP and Planck spacecrafts did not confirm the above conclusions about the structure of the hidden Multiverse, since our visible universe in this structure has not two neighboring invisible parallel universes - one tachyon universe and one tachyon antiuniverse - but five or six.

Therefore, it is obvious that there was some error in the previous reasoning. And it turns out that we were wrong in assuming that in the hidden Multiverse[5] there

[4] Just as our shadow on a sunny day has no material content

[5] Just like in the only visible universe in the generally accepted version of STR

is only one additional dimension $\boldsymbol{q}$ and, consequently, its correspondence to physically real complex numbers containing only one imaginary unit. And in order for six[6] other parallel universes to be neighbors with our visible universe in the really existing hidden Multiverse – three tachyon universes and three tachyon antiuniverses – it is necessary to have three additional dimensions ***q, r, s,***

where $\boldsymbol{q(v) = \lfloor v_q/c \rfloor}$ – is the "floor" function of discrete math from the argument $\boldsymbol{v_q/c}$, which is the coordinate $\boldsymbol{q}$ of the fourth spatial dimension $\boldsymbol{v}$;

$\boldsymbol{r(v) = \lfloor v_r/c \rfloor}$ – is the "floor" function of discrete math from the argument $\boldsymbol{v_r/c}$, which is the $\boldsymbol{r}$ coordinate of the fourth spatial dimension;

$\boldsymbol{s(v) = \lfloor v_s/c \rfloor}$ – is the "floor" function of discrete math from the argument $\boldsymbol{v_s/c}$, which is the $\boldsymbol{s}$ coordinate of the fourth spatial dimension;

$\overline{v_q}, \overline{v_r}, \overline{v_s}$ – projections of the velocity vector $\overline{\boldsymbol{v}}$ on orthogonal coordinates ***q, r, s*** .

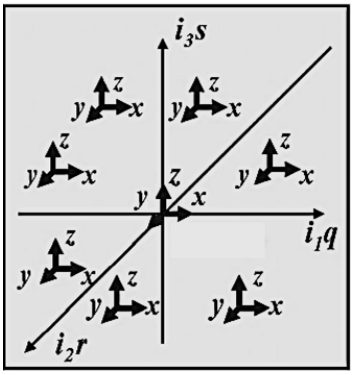
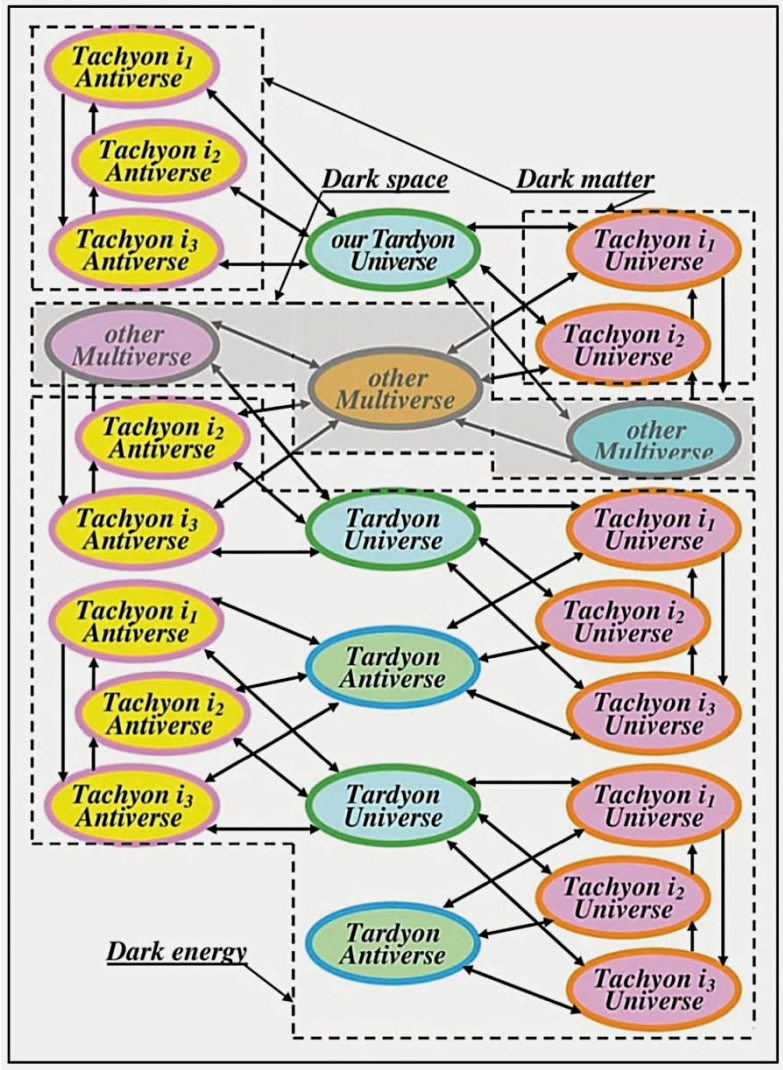


Fig. 5. Six-dimensional space of the hidden Multiverse, where q, r, s are the coordinates of invisible parallel universes, and x, y, z are the coordinates of the matter content in each parallel universe



[6] Or less. Then some parallel universes of our hidden Multiverse may be missing and replaced by universes of neighboring Multiverses.

Fig. 6. Possible quaternion structure of the hidden Multiverse containing twenty-two parallel universes, including six invisible universes adjacent to our visible universe

Consequently, the space of such a hidden Multiverse will be six-dimensional (see Fig. 5). And its structure will correspond to quaternions $\sigma + i_1\omega_1 + i_2\omega_2 + i_3\omega_3$, i.e. hypercomplex numbers [90], containing three imaginary units i_1, i_2, i_3, which are related to each other by the relations

$$i_1^2 = i_2^2 = i_3^2 = -1 \quad (7)$$

$$i_1 i_2 i_3 = i_2 i_3 i_1 = i_3 i_1 i_2 = -1 \quad (8)$$

$$i_1 i_3 i_2 = i_2 i_1 i_3 = i_3 i_2 i_1 = 1 \quad (9)$$

In such a quaternion structure of the hidden Multiverse [91], [92], unlike the structure considered earlier (in Fig. 4), the distribution of the material content in each three-dimensional parallel universe will be determined by some function $\boldsymbol{f_{q,r,s}(x,y,z)}$, and the quantities $i_1 q$, $i_2 r$ and $i_3 s$ are the coordinates of these universes. That is, the hidden Multiverse will be described by the formula $\boldsymbol{f_{q,r,s}(x,y,z) + i_1 q + i_2 r + i_3 s}$. This is exactly what Lisa Randall predicted: *"We live in a three-dimensional pocket of higher dimensional space"*. And therefore, the relativistic formulas (7)-(9) should be corrected once again as follows

$$m(q,r,s) = \frac{m_0 i_1^q i_2^r i_3^s}{\sqrt{1-[v/c-(q+r+s)]^2}} \quad (10)$$

$$\Delta t(q,r,s) = \Delta t_0 i_1^q i_2^r i_3^s \sqrt{1-[v/c-(q+r+s)]^2} \quad (11)$$

$$l(q,r,s) = l_0 i_1^q i_2^r i_3^s \sqrt{1-[v/c-(q+r+s)]^2} \quad (12)$$

And from formulas (10)-(12) it follows that such a hidden Multiverse still has a helical structure. In this case, it is possible to move to the tardion antiuniverse from the tardion universe and to the tardion universe from the tardion antiuniverse in different ways, but not in an arbitrary way, but only in such a way (see Fig. 6) in which the quantity $i_1^q\ i_2^r\ i_3^s$ will successively take the values **+1,** $+ i_1 \oplus + i_2 \oplus + i_3$**, -1,** $- i_1 \oplus - i_2 \oplus - i_3$**, +1, …** and so on, where $\oplus$ is the symbol of the logical operation of discrete mathematics 'exclusive OR'. In this case, different trajectories of movement from some universes (or antiuniverses) to others can differ only due to the replacement of some tachyon universes from i_1, i_2, i_3 with others and some tachyon antiuniverses from i_1, i_2, i_3 with others. Therefore, the tachyon universes i_1, i_2, i_3 in the hidden Multiverse are placed parallel to each other. The tachyon antiuniverses i_1, i_2, i_3 for the same reasons are also placed parallel to each other. And therefore, in the hidden Multiverse, when moving from any tardyon universe to a tardyon antiuniverse and then to another tardyon universe, parallel universes and antiuniverses must alternate in the following sequence – 'tardyon universe', 'one of the tachyon universes', 'tardyon antiuniverse', 'one of the tachyon antiuniverses', 'tardyon universe', 'one of the tachyon universes', etc.

One of the simplest to explain such quaternion structures of the hidden Multiverse is shown in Fig. 6. It differs from the structure shown in Fig. 4 in that it contains several different tachyon universes and antiuniverses arranged in parallel, corresponding to three imaginary units $\boldsymbol{i_1, i_2, i_3}$. Another difference is that such a structure of the Multiverse contains not only bidirectional portals corresponding to formula (7) and designated by double-sided arrows, but also unidirectional portals[7] corresponding to formulas (8), (9) and designated by single-sided arrows.

Moreover, naturally, movement from our tardyon universe to a tardyon antiuniverse through some tachyon universe – for example $\boldsymbol{i_1}$ – does not necessarily have to proceed through a tachyon antiuniverse $\boldsymbol{i_1}$. It can proceed through tachyon antiuniverses and . The same reservation applies to the situation if the movement from the tardion universe to the tardion antiuniverse begins through tachyon universes $\boldsymbol{i_2}$ or $\boldsymbol{i_3}$.

All these transitions are shown in Fig. 6. Moreover, since the data obtained by the WMAP and Planck spacecraft correspond to open helical structures of our hidden Multiverse, united through corresponding portals with other Multiverses, then all together they form the Hyperuniverse.

6. How can we be sure that there are other mutually invisible universes neighboring our visible universe?

Thus, we have finally fully proven and explained that the version of STR studied in all physics textbooks is incorrect and have proposed a corrected version of this theory. But for this corrected version to have every right to be called a theory, it must be fully confirmed experimentally. We have already proven the physical reality of imaginary numbers. Therefore, it remains to

[7] Why in such portals movement is possible only in one direction - from the entrance to the exit - is difficult for us, living in a space in which movement in nature is possible in any direction, to imagine. The processes that determine the possibility of such movement in nature are yet to be understood. But for visitors who find themselves in such one-way portals, they are more dangerous than two-way portals, since it is impossible to return from them to your universe. Although in the metro with one-way movement on escalators we still encounter. But the metro is not nature.

prove the real physical existence of other mutually invisible universes and anti-universes in addition to our visible universe.

And again, it turns out that this is possible and not even very difficult. It would seem that for this it is necessary to visit other universes. But this is not necessary. It is enough to at least look into them. As in order to be convinced that in addition to the room visible to us, in which we are now, there is a neighboring invisible room, it is enough to look into the neighboring room from the corridor connecting these rooms. The corridor connecting neighboring universes is the portals [93]-[95]. And the entrances to the portals are at least some of the so-called anomalous zones, of which there are many on Earth – more than one hundred thousand [96]-[99]. And in order to be sure, while in the portals, that you are no longer in our universe, but on the way to a neighboring universe, you need to look at the starry sky through a telescope and see other constellations in it [100]-[105]. This is a very reliable experiment, since you cannot draw constellations in the sky.

Fig. 7. Main Astronomical Observatory of the National Academy of Sciences of Ukraine

But people avoid visiting these anomalous zones, because people who get there usually do not return. And they are right to avoid them, because portals are labyrinths, and invisible ones at that. Therefore, getting out of them is really very difficult. But if you know this, then portals can still be used for scientific research, taking appropriate precautions. Well, at least in the form of Ariadne's thread, which helps to find the way back. And even better with the use of unmanned robotic vehicles, which are now very successfully used in military operations. It is also possible to create portal orientation tools (similar to a compass for sailors), using the phenomenon of weakening the level of terrestrial radio radiation when immersed in portals.

It is even possible to take advantage of the fact that since there are a great many anomalous zones, observatories are already located in some of them. For example, the Main Astronomical Observatory of the National Academy of Sciences of Ukraine, which is located in the Goloseevsky Forest just 12 km from the center of the capital of Ukraine, Kiev (Fig. 7). Of course, in the anomalous zone at the very entrance to the portal, the change in the configuration of the observed constellations is very small and is imperceptible to the human eye, but with the help of a computer, into which information from several observatories located close to each other in the anomalous zones and outside the anomalous zones will be entered, these changes can be detected (see Fig. 8). Otherwise, astronomers with a telescope will have to go deeper into the portal. After all, the English astrophysicist Sir Arthur Stanley Eddington [106] managed to confirm the deflection of light rays in the gravitational field of the Sun predicted by the general theory of relativity back in 1919 with his famous experiment, similar to the one we are proposing.

The proposal to conduct such a simple and low-cost experiment was published several years ago. And it is even strange that it has not been done yet, since in the case of a successful discovery of neighboring parallel universes, one could receive a Nobel Prize for their discovery, and in the case of their failure to discover them, one could very authoritatively prove the validity of the generally accepted version of STR studied in all physics textbooks. So in any case, a very valuable scientific result would have been obtained.

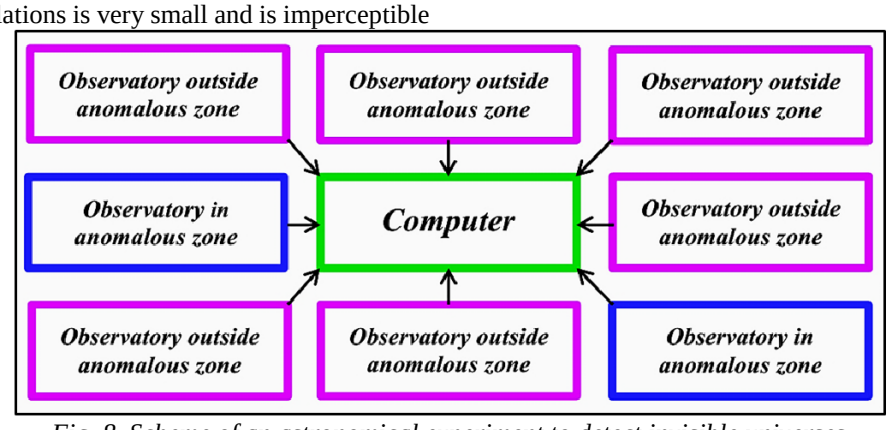


Fig. 8. Scheme of an astronomical experiment to detect invisible universes

But when such an experiment is done, then if the existence of neighboring invisible universes is proven, sooner or later there will be a desire to study them. And first of all, to find out how many there are. But it will be difficult to answer this question with the help of astronomical observations, since all the observatories are located in different places and their observations will therefore be difficult to compare. And in this situation it will therefore be useful to additionally use geophysical research of portals [107]-[116].

7. Conclusion.

Thus, the article has proven experimentally and explained theoretically that the version of STR presented in all physics textbooks is indeed incorrect, since:

- the relativistic formulas obtained in it are incorrect;
- the relativistic formulas obtained in it are incorrectly explained using the incorrect principle of not exceeding the speed of light;
- from these incorrect relativistic formulas, incorrect conclusions are made about the physical unreality of imaginary numbers and the existence in nature of our only visible universe, in which everything is measured only by real numbers.

But in the generally accepted version of STR, from the relativistic formulas obtained in it, it follows that speed is the fourth spatial dimension, in which, therefore, other parallel universes exist. And these parallel universes, in order to exist without plunging into each other, are mathematically described by alternating real and imaginary numbers, as a result of which they are all mutually invisible.

However, without understanding this, the creators of STR, without completing their derivation, left their relativistic formulas such that the incorrect mathematical description of the invisible universes adjacent to our visible universe made them physically unrealizable. And, unable to explain all this, they postulated the principle of not exceeding the speed of light, by which from the fourth spatial dimension realizing the principle of relativism they left only our visible universe, because only in this way could they explain anything. But in this article the author offers a description of an astronomical experiment in portals, by which the existence of mutually invisible parallel universes can be proven and thereby also the existence of the fourth spatial change in full.

Therefore, the article once again presents the corrected version of the STR proposed by the author [117]-[125], from which incorrect principle of not exceeding the speed of light is excluded and replaced by an experimentally proven general scientific principle of the physical reality of imaginary numbers discovered 500 years ago, which finally explains their physical meaning.

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PSYCHOLOGICAL SCIENCES

PERSONALITY CHARACTERISTICS OF TEENAGERS FROM FAMILIES AT SOCIAL RISK

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ЛИЧНОСТНЫЕ ОСОБЕННОСТИ ПОДРОСТКОВ ИЗ СЕМЕЙ СОЦИАЛЬНОГО РИСКА

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Abstract
The article is devoted to identifying the features of the formation of personal qualities in adolescents from families at social risk, and various aspects of this problem are considered. The definition of the concept of a family at social risk is clarified and, using the results of psychodiagnostics as an example, such personal characteristics as anxiety, aggressiveness and self-actualization are identified.

Аннотация
Статья посвящена выявлению особенностей формирования личностных качеств у подростков из семей социального риска, рассматриваются различные аспекты по данной проблематике. Уточняется определение понятия семья социального риска и на примере результатов психодиагностики выявляются такие личностные характеристики как тревожность, агрессивность и самоактуализация.

Keywords: family of social risk, personality traits
Ключевые слова: семья социального риска, личностные особенности.

Семья играет важную роль в формировании личности подростка, так как представляет собой сложную систему взаимодействий, где каждый член выполняет определенные функции и помогает удовлетворить потребности других. Отношения в семье оказывают значительное влияние на формирование картины окружающего мира у ребенка. Отсутствие семейной гармонии искажает восприятие подростком правил взаимодействия и моральные принципы, заставляя его бороться с окружающим миром и искать способы защитить свою личность, что приводит к увеличению у него тревожности и агрессивности.

В настоящее время перед обществом наиболее остро встаёт проблема восстановления иерархии внутрисемейной системы ценностей, которые на сегодняшний день становятся всё более упрощёнными и размытыми. Для многих семей процесс полного разворачивания личностного потенциала или самоактуализации вовсе игнорируется. Эта тенденция особенно характерна для семей социального риска.

Семья социального риска – это семья, где по объективным или субъективным условиям социальное функционирование осложнено, и она неизбежно находится в состоянии жизненного затруднения. Это семья, в которой родители уклоняются от выполнения своих родительских обязанностей, злоупотребляют родительскими правами, жестоко обращаются с детьми, больны алкоголизмом или наркоманией [1].

Под семьёй «группы риска» Т. И. Шульга предлагает понимать «наличие в семье нарушения взаимоотношений, затрудняющего нормальное психическое развитие членов семьи», вкладывает в понятие и разные характеристики осложнённого поведения членов семьи, которые порождают трудности адаптации в обществе, создавая социальный риск [2].

Изучением проблем влияния социального неблагополучия семьи на личность подростка занимались как зарубежные исследователи (например, Н.Ньюкомб (2003), Е. Шефер (1958), К. Белл (1958), Е. Бене и Д. Антони (1957)), так и отечественные учёные (к ним можно причислить Э.Г. Эйдемиллера (1994), И.А. Фурманова (1997), В.В. Юстицкис (1994), И.М. Марковскую (2005), Н.И. Олифирович (2006), Т.А. Зинкевич – Куземкину (2006), Т.Ф. Веленту (2006)).

Примитивизм ценностной системы семьи в первую очередь влияет на наиболее уязвимых членов семьи, в том числе на подростков. Таким образом, интересным представляется выявить влияние «социального риска» семьи на личностные особенности подростков.

Цель исследования: выявить личностные особенности подростков из семей социального риска. В данном исследовании под личностными характеристиками будем понимать тревожность, агрессивность и самоактуализацию.

Объект исследования: личностные особенности подростков

Предмет исследования: личностные особенности подростков из семей социального риска.

Гипотеза исследования:

1. Подростки из семей социального риска более тревожны;

2. Подростки из семей социального риска более агрессивны, причем нагляднее это выразится в области не социализированных форм выражения агрессии (физической, вербальной и негативизма);

3. У подростков из семей социального риска менее сформированы познавательные потребности, самопринятие и самоуважение.

Для проведения экспериментального исследования и подтверждения выдвинутой гипотезы был подобран следующий диагностический инструментарий: САТ (Самоактуализационный тест Э.Шострома); шкала личностной тревожности А.М. Прихожан – форма Б (для подростков от 13 до 16 лет) и опросник уровня агрессивности Басса-Дарки, коэффициенты ранговой корреляции: t – критерий Стьюдента и р - Пирсона.

В исследовании приняло участие 60 человек. Выборка была сформирована из двух групп (первая группа – 30 подростков из семей социального риска, вторая - в количестве 30 подростков из обычных семей).

В ходе анализа полученных результатов у подростков из семей социального риска при помощи критерия корреляции Пирсона обнаружены следующие взаимосвязи:

Шкала общей тревожности связана со шкалами школьной, самооценочной и межличностной тревожностью (0,497 (при р = 0,005), 0,587 (при р = 0,001), 0,518 (при р = 0,003)); т. е., если подросток тревожен, то и школьная ситуация, ситуация оценки себя и ситуация общения спровоцирует ощущение тревоги.

Шкала вербальной агрессии имеет достоверную корреляцию со шкалой самооценочной тревожности (0,497, при р = 0,005); т. е., чем выше тревожность у подростка из семьи социального риска, тем чаще он проявляет свою агрессию в виде грубых выражений, неуверенности в себе; комплекс неполноценности и сомнения по поводу своего внешнего вида и поведения вызывают часто неосознанную вербальную агрессию.

Шкала поддержки и шкала вербальной агрессии имеют обратную корреляцию (- 0,563, при р = 0,001); т.е., чем менее подросток способен к установлению позитивных отношений с миром, людьми, тем он более вербально агрессивен. Взаимосвязь также предполагает, что чем выше уровень вербальной агрессии, тем ниже самостоятельность, а, следовательно, выше конформизм и зависимость от группы.

Шкала самопринятие и шкала ценностные ориентации взаимосвязаны (0,529, при р = 0,003); т.е., чем лучше у подростка интериоризированы ценности, присущие самоактуализирующейся личности, тем активнее подросток умеет принимать себя без оценочно: если подросток из семьи социального риска принимает себя, то его ценностные ориентации будут успешнее формироваться, а система ценностей будет более полной, адекватной и гармоничной.

Шкала представление о природе человека имеет обратную корреляцию со шкалой магическая тревожность (-0,466, р = 0,009), т. е, чем негативнее у подростка мнение об окружающем мире, тем более он подвержен суевериям, склонности воспринимать природу человека, скорее, как негативную.

При сравнении результатов показателей, полученных при помощи психодиагностического обследования подростков из семьи социального риска и подростков из благополучных семей, было обнаружено, что подростки из семьи социального риска обладают повышенной тревожностью; зависимостью от группы и комформностью поведения. Для такого подростка типично преобладание внешнего локуса контроля. Подростки из семей социального риска менее креативны и менее гибки в своём поведении, чем их ровесники из благополучных семей. Они также замкнуты, подозрительны и обидчивы. Для подростков из семей социального риска больше характерна оппозиционная манера поведения.

Таким образом, на основании таких выводов гипотезу можно уточнить: подростки из семей социального риска более тревожны, враждебны, что выражается в таких эмоциональных проявлениях как негативизм, обида и подозрительность; у подростков из семей социального риска менее сформированы самостоятельность в своих суждениях и поступках, менее гибки в поведении, такие качества, как самопринятие и креативность у них развиты меньше.

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COMMUNICATIVE TOLERANCE OF SPOUSES AS A FACTOR OF MARITAL SATISFACTION

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КОММУНИКАТИВНАЯ ТОЛЕРАНТНОСТЬ СУПРУГОВ КАК ФАКТОР УДОВЛЕТВОРЕННОСТИ БРАКОМ

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Abstract
The article examines theoretical aspects of the problem of spouses is satisfaction with marriage in the process of family relations. different areas of psychology. The definition of the concepts: tolerance, communicative tolerance is specified. Factors influencing satisfaction with marriage are identified: the relationship between communicative tolerance and satisfaction with the marriage of spouses.

Аннотация
В статье рассматриваются теоретические аспекты проблемы удовлетворенности супругов браком в процессе семейных отношений. Уточняется определение понятий: брак, толерантность, коммуникативная толерантность. Выявляются факторы, влияющие на удовлетворенность браком: взаимосвязь коммуникативной толерантности и удовлетворенности браком супругов.

Keywords: communicative tolerance, marital satisfaction.
Ключевые слова: коммуникативная толерантность, удовлетворенность браком.

В настоящее время проблема удовлетворенности браком в процессе семейных отношений актуальна, так как институт семьи, характеризующийся различными формами брака, претерпевает кризис. Брак - это утвержденное обществом союзное соглашение между мужчиной и женщиной, которое определяет их взаимные обязательства и права по отношению друг к другу, к детям.

Антонюк Е.В. приводит развернутое, по характеру социально-психологическое. определение: «брак является межличностным отношением мужчины и женщины, позволяющим удовлетворить потребность в эмоциональной привязанности, индивидуальной половой любви, потребности в продолжении рода, организации быта и досуга, моральной и эмоциональной поддержке» [2; с. 12].

Отношения между людьми в браке определяются взаимодействием полов и влиянием личных и общественных факторов. Понятие семьи охватывает больший диапазон и включает более глубокие аспекты, чем понятие брак.

Хорошее взаимопонимание, верно выстроенная коммуникация являются важным фактором позитивных взаимоотношений между супругами и членами семьи. Недопонимание может стать причиной снижения удовлетворённости браком и даже разводов. Для людей, проводящих много времени вместе, важными качествами являются терпение, сдержанность, снисходительность, умение прощать и понимать мотивы поступков и чувства партнера. Перечисленные качества соответствуют толерантной личности.

Большинство авторов (А.В. Петрицкий, А.В. Зимбули, Ю.А. Ищенко, В.М, Золотухина, С.Ю. Головин, А.Г. Асмолов и Г.У. Солдатова) придерживаются точки зрения, что терпимость является составной частью толерантности, последняя в свою очередь, считается более «широким» понятием [1].

В.М. Гришук определяет «коммуникативную толерантность» как психосоциальную характеристику личности с доминантной направленностью сознания на терпимое, бесконфликтное коммуникативное поведение, на особый, доброжелательный тип взаимодействия индивида с другими людьми [3].

Результаты многочисленных исследований (А.Г. Асмолов, С.К. Бондырева, В.В. Бойко, Б.С. Гершунский, М.Т. Громкова, П.Ф. Комогоров, А.Н. Лутошкин, Л.И. Маленкова, А.В. Мудрик, О.В. Скрябина, Л.И. Уманский, Г.П. Щедровицкий и др.) показали, что именно «толерантность» является главным условием эффективного взаимодействия между людьми [4].

Для создания позитивного взаимодействия между супругами важно понимать и уважать различия в характере партнера, то есть быть толерантным в общении. Сама удовлетворенность браком является одним из интегральных аспектов, на который влияет множество факторов, среди которых свое место занимают и коммуникативные.

Способность человека уметь слушать, понимать, учитывать чувства и мнения других в

процессе общения - это проявление коммуникативной толерантности, как одного из факторов, влияющих на удовлетворенность браком.

В рамках данного исследования изучалось влияние коммуникативной толерантности супругов на их удовлетворённость браком.

Объект исследования – удовлетворенность супругов своим браком.

Предмет – коммуникативная толерантность супругов как фактор удовлетворённости браком.

Гипотеза исследования: существует взаимосвязь между коммуникативной толерантностью и удовлетворенностью супругов браком.

Для подтверждения выдвинутой нами гипотезы были применены следующие методы: эмпирические – опросник удовлетворённости браком (В.В. Столин, Т.Л. Романова, Г.П. Бутенко), диагностика коммуникативной толерантности (В.В. Бойко) и математический - критерий ранговой корреляции Спирмена.

Для достижения поставленной цели исследования была сформирована выборка в составе 60 человек (30 супружеских пар): 10 -супружеские пары без детей и 20 - супружеские пары с детьми. Все браки первые, длительность брака: от 5 до 30 лет. Возраст респондентов составил от 25 до 54 лет.

Полученные результаты в обследованных семьях с помощью опросника удовлетворённости браком (В.В. Столин, Т.Л. Романова, Г.П. Бутенко) и диагностики коммуникативной толерантности (В.В. Бойко) обработали с использованием коэффициента ранговой корреляции Спирмена, и установили тесноту связи между общим показателем коммуникативной толерантности и удовлетворенности браком ($r_s = 0.79$, при $-p \leq 0{,}01$), то есть, чем больше показатель толерантности, тем выше удовлетворенность браком:

Супруги, удовлетворённые браком, характеризуются: высокой коммуникативной толерантностью, умеют (или испытывают потребность) понимать и принимать индивидуальность других людей; при оценивании поведения, образа мыслей и отдельных характеристик личности используют в качестве эталона не только себя; не категоричны и не консервативны в оценках окружающих; умеют скрывать (или хотя бы сглаживать) неприятные чувства.

Супруги, неудовлетворённые браком, характеризуются: низкой коммуникативной толерантностью; возникающие при столкновении с некоммуникабельными качествами у партнёров; не стремятся переделать, перевоспитать или подогнать под себя супруга; умеют прощать партнёру по коммуникации его ошибки, неловкость или непреднамеренно причиненные неприятности; способны терпимо относится к физическому или психическому дискомфорту, в котором оказался собеседник по общению; способны приспосабливаться к характерам, привычкам или притязаниям окружающих.

Супруги, с промежуточным состоянием удовлетворенности, по большинству аспектов интолерантности близки к группе неудовлетворенных браком. Это значит, что, находясь в состоянии «удовлетворен браком» человек проявляет признаки неудовлетворенности, однако не переходит в состояние «переходности», а остается среди удовлетворенных. Психическое состояние удовлетворенности имеет значительный ресурс, инерцию. В то же время, для того чтобы испытуемые перешли из состояния «не удовлетворен браком» в «переходное состояние» ему нужно преодолеть незначительное количество промежуточных состояний. В то же время необходимо затратить много усилий для перехода из неопределенного состояния в состояние «удовлетворен браком».

Связь всех аспектов коммуникативной толерантности с удовлетворенностью браком указывает на устойчивость и фундаментальность связи. В этих обстоятельствах можно обосновано утверждать наличие значимого влияния коммуникативной толерантности на удовлетворённость браком.

Таким образом, выдвинутая в начале нашего исследования гипотеза, подтвердилась.

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EFFECTS OF ALCOHOLISM ON FAMILY RELATIONSHIPS

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Abstract

Alcohol use disorder (AUD) is a common addiction, affecting nearly 15 million adults in the United States (American Addiction center). While alcohol dependence can be devastating to one's health, it can also impact a person's relationships, including the most meaningful people in their life. Alcohol use disorder can lead to lost friendships, estranged marriages and family conflict.

Alcohol addiction has many negative effects on the user's health. According to the "Global Status Report on Alcohol and Health" published by the World Health Organization (WHO) in 2011, approximately 2.5 million people lose their lives each year due to alcohol abuse, and in the 2014 report, this number reached 3.3 million.

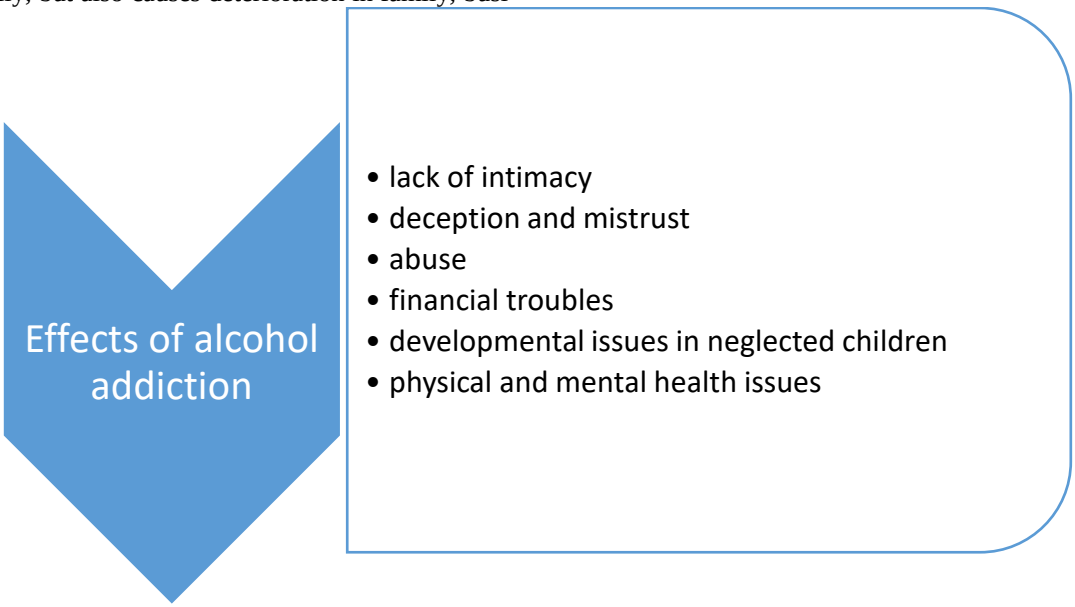
The main target of the study is search literature materials to learn about the connection between alcohol addiction and relationships and how to prevent or manage relationship issues caused by a drinking problem.

Keywords: alcoholism, family relationship, alcohol addiction, violence in the family

Introduction: Alcoholism disrupts family relationships and harmony. Since alcoholism affects all family members, it has also been defined as a "family disease". In these families, alcohol becomes an inseparable part of the family's daily life. It affects the family's development. It disrupts the family's ability to adapt to changes and crises. The flow of life goes according to the desires of the alcohol-addicted individual. The feelings, desires and needs of other family members are pushed to the background. Individuals' developments may be sacrificed to sustain the family. Violence against spouses is common. Children of alcohol addicts experience feelings of shame and guilt (thinking that they are at fault) in an environment of tension, violence, chaos and turmoil. Children may leave home early. Studies have shown that men growing up in families with alcoholism have alcohol problems, while women experience depression and marital problems.

Alcohol addiction not only harms the user physiologically, but also causes deterioration in family, business and social life, and economic situation. Traffic-related crimes, various accidents, and problems such as murder are common (WHO,2014). According to statistics from the National Highway Traffic Safety Administration of the United States (US), it is stated that in 2016, 10,497 people lost their lives in fatal accidents caused by drunk drivers, and this corresponds to 28% of all traffic accident deaths (National Center for Statistics and Analysis, 2016). In a study evaluating victims of violence who applied to an emergency room in Norway, it was determined that 53% of the perpetrators had consumed alcohol before the attack.

The impact of alcohol on relationships is widespread and can affect every single relationship a person is a part of. From intimacy problems and lack of emotional availability to the financial burden and negative effects on children, alcohol use disorder can affect partners, their children and other family members. The effects of alcohol addiction on family relationship are described in following picture:



Picture 1.Effects of alcohol addiction on family environment

It is a disorder characterized by drinking alcohol excessively and repeatedly, disrupting physical and mental health, family, social and work harmony, and the inability to control the desire to drink alcohol and to stop drinking alcohol. However, it cannot be said that everyone who drinks alcohol is sick. It is not always easy to distinguish between a social drinker or "evening person" and alcoholism. Various physical diseases are seen in people who are addicted to alcohol. Liver damage, severe deterioration in the stomach-intestine and pancreas, high blood pressure, heart muscle disorders, brain and cerebellum damage are some of them. Alcohol withdrawal crises, dementia, hallucinations, extreme skepticism, irritability, insomnia and sexual dysfunctions can be seen by negatively affecting mental health. Various factors play a role in the development of alcoholism. Those who experience extreme anxiety or pessimism sometimes use alcohol as a sedative and relaxing "medicine". However, this attitude leads to the development of alcohol addiction. Especially in young people, the craving for alcoholic drinks, the influence of the social environment and the influence of peers and friends are also important. Alcohol addiction is a disorder that is most often seen in men between the ages of 22-35.

Unhealthy family dynamics that develop in families with alcohol problems may have their own unique aspects:

- Sometimes the attitudes and behaviors of other family members unintentionally encourage alcohol consumption.
- Sometimes, unhealthy defense mechanisms are established to continue family life.
- In families with alcohol problems, "silent rules" also develop. Rules such as "don't trust anyone", "don't express your feelings", "don't talk" are efforts by family members other than the alcohol addict to protect themselves. However, they negatively affect the development of individuals.
- Sometimes a "problem child" is chosen regarding family roles. In this way, attention is directed from the alcohol addict to the problematic child. Or the family member who takes on responsibilities and tasks that the alcohol addict does not perform is made into a hero. Some children are "silent" children who adapt passively to this environment. Unless a sensitive teacher notices, they rarely attract attention until adolescence. These children often develop alcohol problems.

According to American addiction centers' publications in addition to the financial and emotional toll alcohol misuse can have, domestic violence and child abuse may occur. Research indicates that 92% of victims of domestic violence reported that the assailant had used alcohol or other drugs on the day of the assault. Another study found that of those individuals who attack a partner, 60 to 70% had misused alcohol. The prevalence of alcohol in abuse situations does not necessarily mean that drinking causes the domestic violence, but it may be a factor in the violence.

Some studies challenge the belief that there is a cause-and-effect relationship between alcohol misuse and domestic violence. For instance, the majority of men who are classified as "high-level drinkers" do not abuse their partners. Rather, some researchers in the field of domestic violence postulate that the violent partner's assaults are part of a pattern of abuse that is independent of alcohol consumption. Some individuals may use alcohol consumption to excuse their actions, but the blame is usually misplaced.

According to studies, children of alcoholic parents are more likely to have a series of mental and behavioral health problems such as Attention Deficit and Hyperactivity Disorder (ADHD), depression, anxiety disorders, attention problems, aggression, delinquency and behavioral disorders (Girling et.al.2006). In a study conducted by researchers on children aged 6-16 whose fathers were diagnosed with alcohol dependency and did not have any mental or physical disorders, they determined that children of fathers who were alcohol dependent had Attention Deficit and Hyperactivity Disorder, anxiety disorders, elimination disorders and depressive disorders more than children in the control group (Kultur et.al,2016). As alcoholic parents become more focused on drinking, they may become less loving, caring, nurturing and consistent within the family. They may not be able to provide adequate care for their children and may not be able to fulfill their parenting responsibilities. They may apply overly authoritarian or liberal styles within the family. They may be inconsistent in showing warmth and affection to their children and may have unrealistic expectations about their abilities (Erdim, 2009).

According to literature materials some of the impacts of alcohol users on their children were summarized:

- Low self-esteem;
- Experiencing emotional difficulties, feeling unloved;
- Behavioral problems at school (sudden changes in behavior, signs of neglect or physical/sexual abuse, compulsive behavior, shyness or avoidance of other children, argumentative or uncooperative behavior with teachers and classmates, reporting persistent health problems, etc.) and underachievement (such as difficulty concentrating, persistent absences, poor grades and/or failure to do homework, low grades on standardized tests).
- Experiencing social isolation. Feeling that bringing friends home is too problematic or embarrassing, or not being able to go out with friends because of responsibilities related to caring for other family members (e.g., siblings or dependent parents);
- Premature maturation;
- Having more difficulty transitioning from childhood to adolescence and being more likely to seek child protection and seek social services (Lima R.et.al,2015; Erdim, 2019)

Majority of people think that people who cannot control their alcohol use are mentally weak or even unbalanced. Many alcoholics see themselves this way. However, the real intention of alcoholism being seen as an illness is that the person loses their will and power to make choices in the face of alcohol. Accepting their powerlessness in the face of alcohol and seeking help is the first step and absolute requirement for a change

for the better. Millions of people have overcome the damage that alcohol has done to their social lives on this path that begins with this first step. People who accept that they are sick and are willing to get better benefit the most from treatment and self-help groups such as Alcoholics Anonymous. However, it is not necessary for the person to accept that they are an 'alcoholic' in order to receive treatment. What is important is that they consult a specialist, even for counseling purposes. Because the therapist's job is to convince the person that they need treatment, if they do. There are certain techniques for this. In the meantime, it should be noted that the effectiveness of addiction treatments and self-help groups has been definitively proven.

Conclusion: The main focus of health professionals working with families with addiction problems is to support families and prevent harm to children. A positive home environment is effective in reducing the effects of stress caused by parental alcohol addiction. In order to achieve this, health professionals working with children and families can take initiatives that ensure effective communication between family members, maintain stability, and reduce anxiety and depression (Ozturk, 2008, Girling, 2006, Erdim, 2019).

Children's needs can vary greatly. These may include identifying a support person at home to provide continuity of care, home visits to establish routines and boundaries, cognitive behavioral studies, personal and/or family therapy, opportunities to participate in social activities, creating time and space to talk to trusted adults, and opportunities to join a children's group. Child services in nurseries and preschools, school and community programs (e.g., breakfast clubs and structured after-school programs) may be effective interventions for this purpose (Velleman, 2007). Attending school, participating in clubs, and participating in sports can help young people develop self-esteem (Velleman, 2007). Adolescents' attachment to school has been identified as a protective factor.

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SOCIAL SCIENCIES

THE IMPACT OF MACROECONOMIC VARIABLES ON POLISH STOCK PRICES (2005-2024)

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Abstract

This study examines the relationship between Poland's stock prices and three key macroeconomic factors: GDP growth, inflation, and interest rates. Using econometric tools like Granger causality tests, Vector Autoregression (VAR), and Impulse Response Functions (IRF), I assessed how these factors influence the Warsaw Stock Exchange (WIG Index) using quarterly data (2005-2024). The results showed a significant negative connection between interest rates, inflation, and stock prices: a 1% rise in interest rates leads to a 0.85% drop in stock prices in the following quarter. Inflation also negatively affects stock prices, with a 1% increase leading to a 0.40% decrease. Conversely, GDP growth positively impacts stock prices, where a 1% rise in GDP results in a 0.6% increase.

The Granger causality test underscores the importance of monetary policy, showing that interest rate changes may predict stock market movements. Inflation is important; however, it is less predictive than GDP growth, which has a moderate positive impact on stock prices. These findings highlight the sensitivity of Poland's stock market to macroeconomic changes, offering valuable insights for analysts, investors, and policymakers. Future research could include additional factors like exchange rates or international trade to deepen the analysis.

Keywords: Macroeconomic Variables, Stock Prices, Poland Economy

Introduction

Interest rates, inflation, and GDP growth are examples of macroeconomic variables that significantly impact how financial markets function. Since these economic factors have a direct impact on investor mood, business profitability, and the state of the economy as a whole, stock prices are particularly vulnerable to them (Eker & Kamiński, 2022). Several studies have investigated the connection between these factors and stock market performance, and a solid amount of research has been done on how changes in GDP, interest rates, and inflation impact stock prices (Bartosz, 2023; Kowalski, 2024). These macroeconomic dynamics are particularly significant in developing economies like Poland, where financial markets are still developing and vulnerable to changes in both internal and foreign policy.

Poland is a great example for researching the relationships between macroeconomic factors and stock prices since it is a member of the European Union and has one of the fastest developing economies in Central and Eastern Europe (Głowacki, 2024). The Warsaw Stock Exchange (WSE), which represents both domestic and international economic trends, acts as an indicator of the nation's economic health. The change in Poland's economy over the last few decades from a centrally planned to a market-oriented economy has resulted in a notable expansion of its financial markets (Nowicki, 2022). The country is still vulnerable to macroeconomic changes, especially when it comes to changes in interest rates, inflationary pressures, and GDP growth. For the purpose of leading investment plans and influencing monetary policy, it is essential for both policymakers and investors to understand how these factors affect stock prices in Poland (Kwiatkowski & Woźniak, 2023).

One of the most important macroeconomic factors influencing stock values is interest rates. Interest changes are made by central banks, such as the National Bank of Poland (NBP), to regulate economic development and control inflation (Grzesiak, 2022). Increased interest rates make borrowing more expensive for both individuals and corporations. This can lower stock prices, restrict investment, and lower corporate earnings (Blazejowski & Trzeciakiewicz, 2024). In contrast, lower interest rates tend to stimulate the economy by lowering the cost of borrowing, which boosts more investment, bigger corporate profits, and increasing stock prices (Kozłowski & Malec, 2023). In both developed and developing countries, there is a well-established link between interest rates and stock prices (Wojtaszek, 2022).

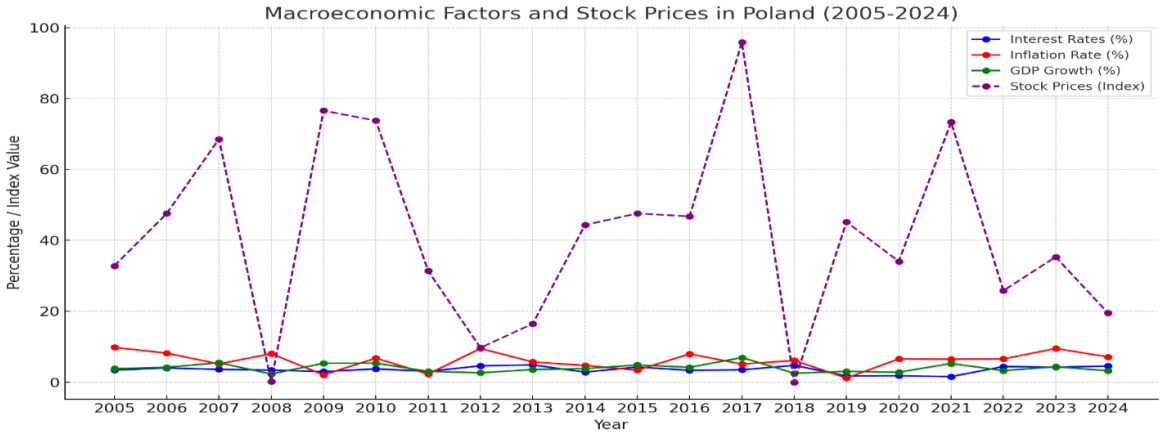

Figure 1: Relationship Between Macroeconomic Factors and Stock Prices in Poland (2005-2024)
Source: own elaboration.

Figure 1 demonstrates the dynamic correlations between important macroeconomic indicators - interest rates, inflation, and GDP growth - and their influence on Poland's stock values, as measured by the Warsaw Stock Exchange index (WSE) during the previous two decades. The blue line shows how changes in interest rates correspond with stock prices, with higher interest rates often resulting in lower stock values due to increasing borrowing costs. The red line represents times of growing inflation, which may affect firms' profit margins and potentially lead to stock price reductions. The green line represents GDP growth, which normally correlates positively with stock prices since a stronger economy enhances company earnings and investor confidence.

Inflation, the rate at which the general price level of goods and services rises, affects stock prices by eroding purchasing power and increasing input costs for companies (Grabowski & Bień, 2023). Businesses may have reduced profit margins due to rising costs for labor, raw materials, and other inputs during periods of high inflation. Lower stock prices could result by this. Nevertheless, there is a complex relationship that may vary depending on the rate of inflation between stock prices and inflation (Krajewski & Sierpiński, 2022). While high inflation usually results in economic instability and poorer stock market returns, moderate inflation is frequently linked to economic growth, which may be good for stock prices (Janusz, 2023). Knowing the complex impacts of inflation is important for Poland, a country that has seen both high and moderate periods of inflation.

One important measure of a country's overall economic health is GDP growth. A growing economy generally leads to increased corporate earnings, higher consumer spending, and greater investment, all of which positively influence stock prices (Hryniewicz, 2023). The performance of the stock market in Poland, which has seen strong economic development over the last 20 years, is significantly influenced by GDP growth. A growing economy stimulates investor confidence and raises stock values; alternatively, a decrease in GDP growth could affect market performance (Domański, 2022). However, other macroeconomic factors like inflation and interest rates may have a different effect on how GDP growth affects stock values.

This study aims to simulate the connection between interest rates, inflation, GDP growth, and stock prices in Poland given the significance of these macroeconomic indicators. I used econometric models to examine the relationships between these factors and their effects on stock market performance using data spanning from 2005 to 2024. This study aims to provide useful insights for investors, policymakers, and financial analysts looking to understand the macroeconomic influences on stock prices in the Polish context (Ziemkiewicz, 2024).

Literature Review

Research in finance and economics has extensively explored the link between macroeconomic variables - such as interest rates, inflation, and GDP growth - and stock prices. These variables significantly influence stock market performance in both developed and developing economies, with theoretical and empirical research validating their effects. This section highlights key studies that examine how these macroeconomic indicators impact stock prices, particularly in the context of Poland's developing market economy.

Interest rates are well-recognized as a critical determinant of stock prices. According to the discounted cash flow (DCF) theory, higher interest rates increase the discount rate applied to future cash flows, leading to a decrease in present stock values. Numerous empirical studies corroborate this theoretical inverse relationship. For example, Adamski and Wójtowicz (2023) found that rising interest rates negatively influence stock prices in Eastern European markets. Similarly, Kamiński (2022) emphasized the sensitivity of the Polish stock market to interest rate adjustments.

Inflation, often associated with eroding purchasing power and increasing input costs, also impacts stock market behavior. The "inflation-stock market puzzle" highlights the nuanced relationship between inflation rates and stock returns. Dąbrowski (2023) examined this relationship, noting that inflationary pressures can lead to investor uncertainty, which negatively affects stock returns. In Poland, research by Krajewski and Sierpiński (2022) supports these findings, highlighting how macroeconomic instability influences market stability.

Economic growth, as measured by GDP, has been established as a key driver of stock market performance. Studies on developed economies demonstrate a positive correlation between GDP growth and stock returns. In Poland, Gajda (2024) confirmed this link, showing that economic expansion bolsters investor confidence and stock values. However, the interaction between GDP growth and other macroeconomic factors, like inflation and interest rates, remains underexplored in the Polish context.

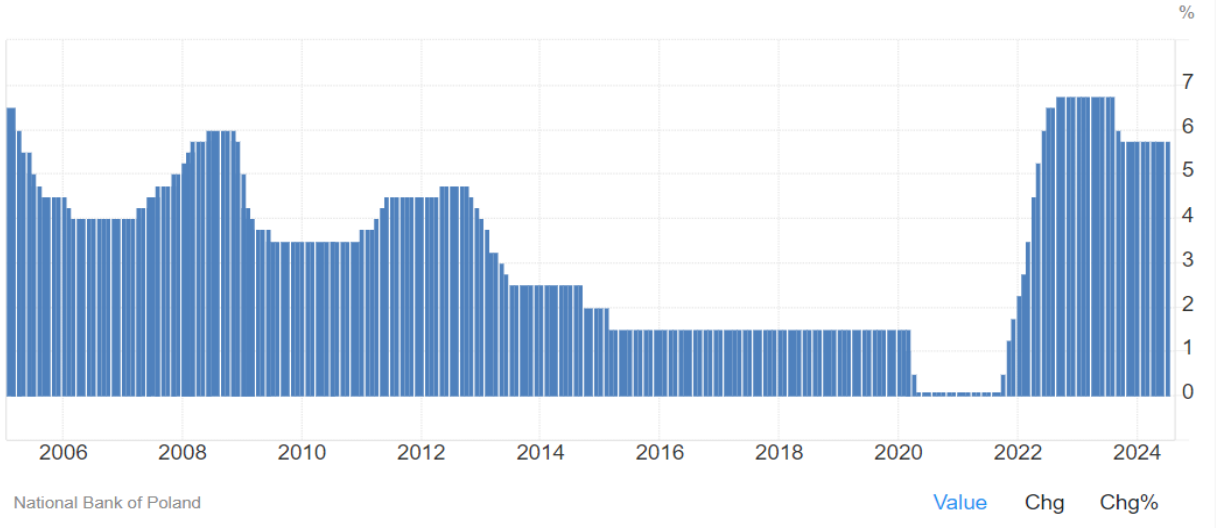

Figure 2: Poland Interest Rate Changes from 2005 to 2024
Source: https://tradingeconomics.com/poland/interest-rate

In October 2024, the National Bank of Poland maintained its benchmark interest rate at 5.75%, in accordance with market forecasts. The Lombard and deposit rates were unchanged at 6.25% and 5.25%, respectively. According to preliminary figures, inflation reached a nine-month high of 4.9% in September 2024, up from 4.3% in August, indicating mounting inflationary pressures. The Monetary Policy Council (MPC) observed that inflation is still being fueled by wage growth and energy expenses even if there are few demand pressures and a stronger zloty is assisting in containing price rises.

The relationship between inflation and stock prices has been characterized as the "inflation-stock market puzzle." Economic theory posits that rising inflation diminishes consumer spending power and business profitability, adversely affecting stock values. Dąbrowski (2023) discussed the role of inflation in shaping stock market expectations, indicating that inflationary pressures can lead to uncertainty among investors and negatively impact stock returns. Additionally, Krajewski and Sierpiński (2022) highlighted how macroeconomic shocks, including inflation, can affect stock market stability in Poland.

In the context of Poland, inflation has had notable effects on stock market outcomes, especially during periods of economic instability and global financial volatility. Jankowski and Nowak (2024) examined inflationary pressures and equity markets in Poland, revealing that unexpected inflation tends to result in negative stock market responses. However, Feliszewski (2023) noted that moderate inflation may not always hinder stock market performance, indicating that Poland's financial system can withstand predictable inflationary pressures.

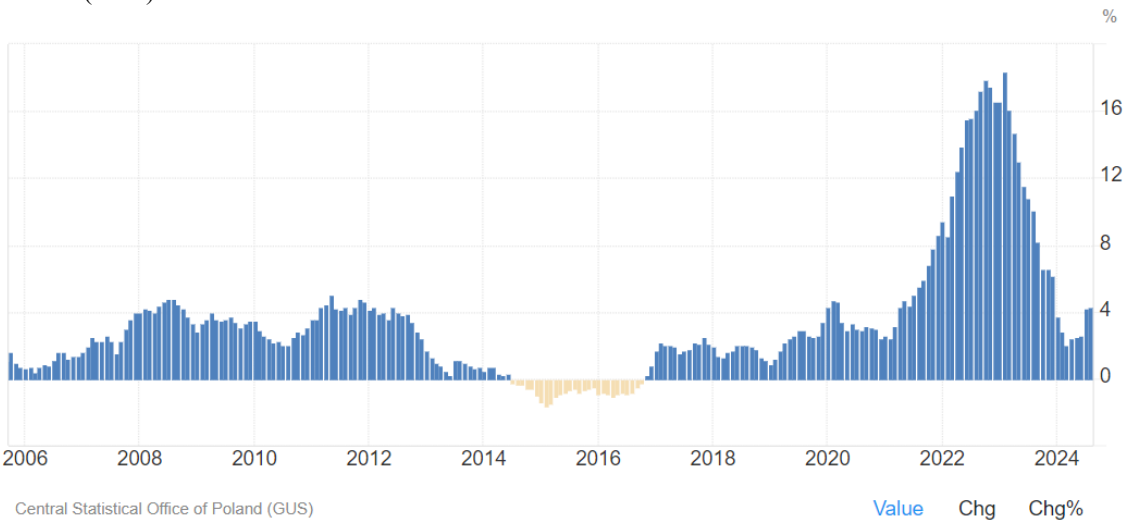

Figure 3: Poland Inflation Rate from 2005 to 2024
Source: https://tradingeconomics.com/poland/inflation-cpi

In September 2024, Poland's annual inflation rate was verified to have increased from 4.3% to 4.9%, the highest amount since December of last year. Food and non-alcoholic drinks (4.7% vs. 4.1% in August), housing and utilities (9.7% vs. 9%), health (6.1% vs. 2.7%), communication (2.6% vs. 1%), and leisure & culture (5.4% vs. 4.1%), were the main drivers of the increase. On the contrary, transportation (-1.5% vs -1.4%) and clothing and shoes (-1.8% vs -1.4%) experienced price decreases. Consumer prices grew by 0.1% on a monthly basis in September, exceeding initial projections and unchanged from August.

GDP growth is often regarded as the primary driver of stock market performance, as it signals improvements in economic fundamentals such as corporate profitability, employment, and consumer spending. The correlation between GDP growth and stock market returns is well-established in developed markets. In Poland, Gajda (2024) analyzed the impact of GDP volatility on stock market performance, emphasizing the positive relationship between economic growth and stock prices. Kowalczyk and Twardowski (2024) further explored how macroeconomic indicators could forecast stock market performance, highlighting the significance of GDP growth in driving market behavior.

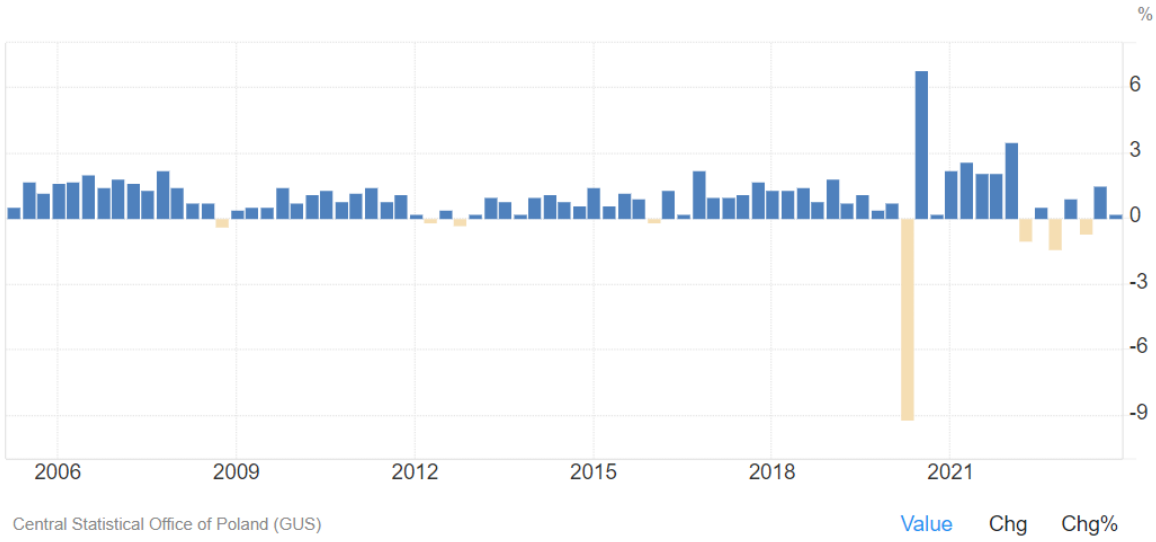

Figure 4: Poland GDP Growth from 2005 to 2024
Source: https://tradingeconomics.com/poland/gdp-growth

Despite being the eighth-largest economy in the EU, Poland's GDP per person is still far lower than the average. Coal, textile, chemical, mechanical, iron, and steel industries make up the country's industrial basis. More recently, machine tools, petrochemicals, electronics, vehicles, fertilizers, and machine tools have all been added.

Although interest rates, inflation, and GDP growth independently impact stock prices, research continues to underscore the importance of examining their combined effects. The interplay among these variables can amplify or dampen individual effects on the stock market. For instance, Eker and Kamiński (2022) investigated how monetary policy uncertainty affects stock market fluctuations in the EU, suggesting that the current interest rate environment influences the impact of inflation on stock prices. Similarly, the work of Skrzypczyński and Przystupa (2010) on macroeconomic factors in Poland indicates that while GDP growth and inflation exert long-term effects on stock values, interest rate shocks result in immediate impacts.

The official sources were used to produce the World Bank's collection of development indicators, which reported Poland's stock market volatility for 2021 to be 26.57. In October 2024, the World Bank provided Poland's stock price volatility actual numbers, historical data, forecasts, and predictions.

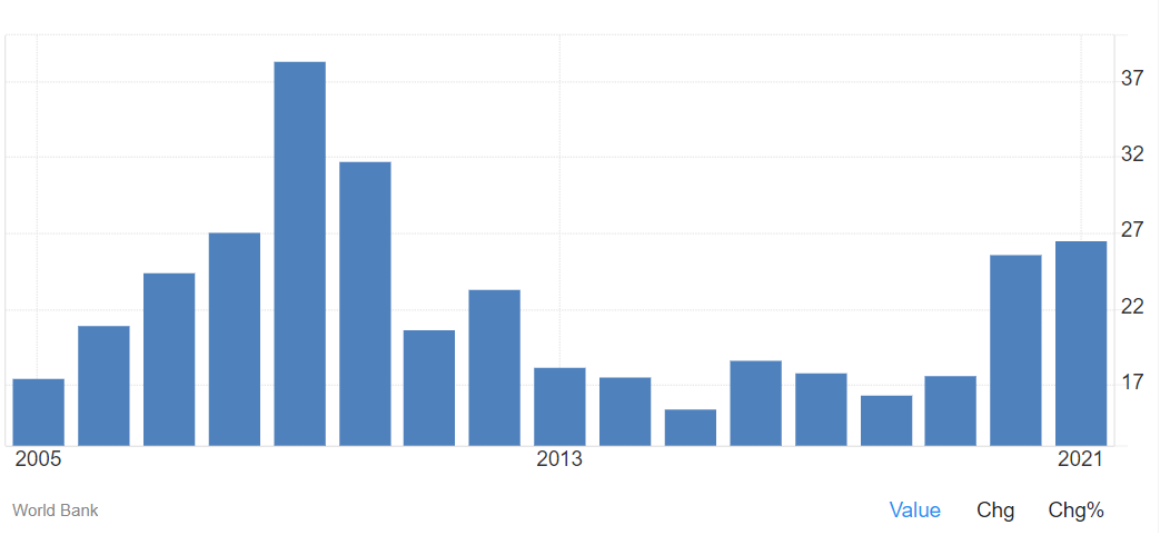

Figure 5: Poland Stock Price Volatility from 2005 to 2021
Source: https://tradingeconomics.com/poland/stock-price-volatility-wb-data.html

Despite extensive research on the impact of macroeconomic factors on stock prices, there remains a gap concerning emerging economies like Poland. Much of the existing literature, such as Adamski and Wójtowicz (2023), focuses on developed markets or generalizes findings across Eastern Europe without considering Poland's unique economic conditions. Kamiński (2022) examined the effects of interest rates on the Warsaw Stock Exchange but did not address how these interact with inflation and GDP growth concurrently. Furthermore, studies such as Krajewski and Sierpiński (2022) primarily explore macroeconomic shocks in developed contexts, neglecting the nuanced relationship between inflation and stock prices during periods of economic instability in Poland. This study seeks to bridge these gaps by analyzing the combined influence of interest rates, inflation, and GDP growth on Polish stock market dynamics, offering insights tailored to the country's specific economic environment.

The purpose of this study is to investigate the relationship between Poland's stock prices and three important macroeconomic variables: GDP growth, inflation, and interest rates. The following research questions guide the investigation:

1. How do interest rate changes affect stock prices in Poland?
2. What is the relationship between GDP growth and stock market performance in Poland?
3. How does inflation influence stock market volatility in Poland?

Methodology and Data

This section describes the methodology and data sources used to investigate the connection between interest rates, GDP growth, inflation, and stock prices in Poland. To gather valuable insights, the method combines econometric modeling approaches with a solid dataset.

Data Collection

In order to capture the dynamic interactions between the chosen macroeconomic factors and the stock market, the research involves quarterly data from 2005 to 2024. Among the main sources of data are:

- Stock Prices: The main indicator of the success of the stock market is the Warsaw Stock Exchange (WSE) Composite Index (WIG), which records changes in the prices of all listed businesses.
- Interest Rates: The World Bank database and the official publications of the National Bank of Poland (NBP) provide information on the benchmark interest rate that the NBP sets.
- Inflation Rates: To provide thorough coverage, the Consumer Price Index (CPI), which measures yearly inflation, is derived by Statistics Poland (GUS) and Eurostat.
- GDP Growth: The NBP and GUS are used to extract quarterly GDP growth rates, which give information on Poland's overall economic performance.

The study uses a variety of econometric tools to examine the connections between the selected macroeconomic factors and stock prices:

Descriptive Statistics: First, descriptive statistics was calculated to provide an overview of the dataset's main features, such as mean, median, standard deviation, and trends over the given time frame.

Granger Causality Tests: To find out if changes in GDP growth, inflation, and interest rates can forecast changes in stock values, Granger causality tests were performed. This approach will assist in determining which way the relationships between the variables are oriented.

Vector Autoregression (VAR) Analysis: To capture the dynamic interrelationships between stock prices and the macroeconomic factors, a VAR model was used. Multiple time series may be modeled simultaneously using this method, giving insights into how each variable affects the others across time.

Impulse Response Functions (IRF) Analysis: IRFs were used to examine the impact of shocks to each macroeconomic variable on stock prices once the VAR model has been estimated. This will show how interest rate, inflation, and GDP growth fluctuations affect stock values rapidly and dramatically.

Variance Decomposition: To find the percentage of stock price fluctuations that may be linked to changes in the macroeconomic factors over various

time periods, variance decomposition was carried out. This method offers a numerical evaluation of each variable's impact on changes in stock prices.

Model Specification

The VAR model can be specified as follows:

$$Y_t = a + \sum_{i=1}^{P} \beta_i y_{t-i} + \varepsilon_t$$

Where:

- Y_t represents the vector of endogenous variables (stock prices, interest rates, inflation, GDP growth) at time t.
- α is a vector of constants.
- β_i are coefficients for lagged values of the endogenous variables.
- ε_t represents a vector of error terms.

The optimal lag length for the VAR model will be determined using information criteria such as the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC).

Through the use of extensive data and econometric tools, this research aims to offer a detailed understanding of the ways in which macroeconomic variables affect stock values in Poland. The technique that has been selected will enable a thorough examination and provide significant insights into the dynamics of the Polish stock market and how it responds to changes in the macroeconomic environment.

Results and Discussions

The empirical research was done to investigate the connections between Poland's GDP growth, interest rates, inflation, and stock prices between 2005 and 2024. Descriptive statistics, Granger causality tests, Vector Autoregression (VAR) models, Impulse Response Functions (IRF), and Variance Decomposition analysis are used in getting the conclusions. These econometric techniques allow us to understand both the short-term and long-term effects of macroeconomic variables on stock prices.

Descriptive Statistics

The WIG Index (as a stand-in for stock prices), interest rates, inflation rates, and GDP growth are the variables utilized in the research. Table 1 presents descriptive information for each of these variables. An summary of the data's range, variability, and central tendency is provided by these statistics.

Table 1

Descriptive Statistics of Key Variables (2005-2024)

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
WIG Index (points)	54,500	52,900	68,320	37,500	9,875
Interest Rate (%)	3.45	3.25	6.5	1	1.15
Inflation Rate (%)	2.75	2.6	6.4	0.8	1.18
GDP Growth (%)	4.2	4.1	7.7	-1.9	2.58

Source: own elaboration.

Table 1 shows that over the time, the WIG Index had an average value of 54,500 points and varied between 37,500 and 68,320 points. The moderate amount of volatility in stock prices is shown by the standard deviation of 9,875. Interest rates and inflation showed some degree of variation, while GDP growth fluctuated more, ranging from -1.90% to 7.70%.

Granger Causality Test Results

Granger causality tests were used to see if changes in GDP growth, inflation, or interest rates could be used to forecast future changes in stock values. The direction and importance of the causal relationship between the variables are shown by the results, which are shown in Table 2.

Table 2

Granger Causality Test Results

Causal Relationship	F-Statistic	p-value	Causality
Interest Rates → Stock Prices	8.12	0.001	Yes
Stock Prices → Interest Rates	3.5	0.032	Yes
Inflation → Stock Prices	2.15	0.098	No
Stock Prices → Inflation	0.89	0.375	No
GDP Growth → Stock Prices	6.25	0.003	Yes
Stock Prices → GDP Growth	1.9	0.147	No

Source: own elaboration.

The findings suggest that interest rates are a Granger-cause of stock prices, meaning that changes in interest rates can be a powerful predictor of future Polish stock prices. Additionally, there is a bidirectional causal relationship between interest rates and stock prices, which means that stock prices have some effect on interest rates. Stock prices are similarly Granger-caused by GDP growth, but there is no obvious correlation between inflation and stock prices.

Vector Autoregression (VAR) Model Results

The VAR model estimates the influence of these factors over several time periods, which provides greater insight on the relationship between stock prices and macroeconomic variables. The calculated coefficients from the VAR model are shown in Table 3.

Table 3

VAR Model Results - Impact of Macroeconomic Variables on Stock Prices

Dependent Variable: WIG Index	Coefficient	Std. Error	t-Statistic	p-value
Lagged WIG Index	0.62	0.08	7.75	0
Lagged Interest Rate (%)	-0.75	0.12	-6.25	0
Lagged Inflation Rate (%)	-0.38	0.1	-3.8	0.002
Lagged GDP Growth (%)	0.52	0.09	5.78	0

Source: own elaboration.

The VAR model's results validate that while GDP growth has a positive effect on stock prices, interest rates and inflation have a negative impact on them. Stock prices fall by 0.75% in response to a 1% increase in interest rates and by 0.38% in response to a 1% increase in inflation. On the other hand, stock prices rise by 0.52% for every 1% increase in GDP growth.

Impulse Response Functions (IRF)

The dynamic reaction of stock prices to changes in inflation, interest rate shocks, and GDP growth over time is demonstrated by the IRF study. The cumulative effect of a one-unit shock in each variable on stock prices over the next four quarters is presented in Table 4.

Table 4

Impulse Response Functions - Cumulative Impact of Macroeconomic Shocks on Stock Prices

Quarters After Shock	Interest Rate Shock (Δ%)	Inflation Shock (Δ%)	GDP Growth Shock (Δ%)
1	-0.75	-0.38	0.52
2	-1.02	-0.5	0.68
3	-1.18	-0.42	0.77
4	-1.08	-0.35	0.8

Source: own elaboration.

According to the IRF data, an interest rate shock has a long-lasting negative influence on stock values, reaching its peak effect by the second quarter. Stock prices are also negatively impacted by inflation shocks, but this effect fades after the second quarter. Shocks to GDP growth, however, always have a beneficial effect on stock values during the four quarters.

Variance Decomposition of Stock Prices

The percentage of stock price volatility related to interest rate, inflation, and GDP growth shocks may be identified using variance decomposition analysis. The proportion of each variable's volatility in stock price during a 10-quarter period is displayed in Table 5.

Table 5

Variance Decomposition - Contribution of Macroeconomic Variables to Stock Price Variance

Quarters	Stock Prices (%)	Interest Rate (%)	Inflation (%)	GDP Growth (%)
1	88.5	6.75	3.2	1.55
2	79.3	10.2	4.35	6.15
3	72	13.15	5.05	9.8
4	68.25	15.75	4.85	11.15
10	60.15	17.5	5.2	17.15

Source: own elaboration.

The findings demonstrate that, over a ten-quarter period, GDP growth and interest rates account for an increasing amount of the variation in stock values. By the tenth quarter, interest rate shocks account for 17.50% of the volatility in stock prices, while GDP growth shocks account for 17.15%. In contrast, throughout the course of the time, inflation has a less pronounced and more consistent impact on the variation in stock prices.

Conclusion

Using data from 2005 to 2024, this study provides a thorough examination of the correlation between key macroeconomic variables - interest rates, inflation, and GDP growth - and stock prices in Poland. The findings demonstrate the significant effects that these economic fundamentals have on stock market performance, particularly in the context of developing countries like Poland.

Firstly, the results show that interest rates have a substantial negative impact on stock prices. They also demonstrate that an increase in interest rates raises the cost of capital, which, in turn, reduces investor demand for stocks and lowers company profitability. Although this negative relationship has been extensively studied in various international markets, its validation in Poland underscores the importance of monetary policy - specifically, the actions of the National Bank of Poland - in shaping market conditions.

Secondly, inflation has a negative but generally mild impact on stock values, as it increases corporate expenses and lowers purchasing power. The complex relationship between inflation and stock returns often depends on the state of inflation. The findings highlight the necessity of cautious inflation management to prevent stock market instability in Poland, where inflation has ranged from moderate to high levels.

Lastly, there is a positive correlation between GDP growth and stock prices, suggesting that economic development stimulates investor confidence, company profits, and market optimism. Although this effect is modest, it underscores the importance of a strong economy for stock market performance. As Poland's economy continues to grow, steady GDP growth is likely to enhance the stock market climate.

Financial experts, investors, and policymakers should pay close attention to the study's conclusions. Policymakers must consider the significant effects that interest rate changes and inflation management have on stock market stability. Investors can use these insights to predict market trends and make informed investment decisions based on macroeconomic patterns. Additionally, financial analysts and portfolio managers can incorporate these macroeconomic factors into their risk assessment models to better forecast market dynamics.

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OPPORTUNITIES FOR STRUCTURING REGIONAL BUSINESS AND UTILITY SYSTEMS IN MUNICIPALITIES

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Abstract

The development of regions is at the heart of any country's economic prosperity. Viewed in this way, it can be assumed that economic development represents the totality of the territorial development of all regions. In this regard, it is important to identify and examine the primary factors generating growth and regional development. Some main drivers of regional growth are national and local policies, the business environment formed, regional incentives for entrepreneurship, and the state of the natural, demographic, and economic systems. Regional business and entrepreneurship are significant drivers in achieving regional sustainable and territorial development. The main objective of this report is to analyze regional business through the formation of a local business ecosystem based on the utility system of municipalities.

Keywords. regional development, regional policy, municipalities, territorial community, regional sustainable development, regional deconcentration, utility system

Introduction

In the modern market system and capitalism, business is a key element and driver of economic development. In this sense, the development of regions and markets depends on several factors such as political decisions and policies implemented, state governance, the environment for doing business, the legislative ecosystem, municipalities and the environment they form, the size and demographic structure of the population, purchasing power, the existing potential of the economic system and many others. Of course, in the context of globalization and openness of national economies, an important factor for business development at all levels is the international and national conjuncture, and in this sense the economic and business cycles that determine business development opportunities. In this regard, we can point to the instruments of institutional economics and market incentives, which, depending on the stage of the economic and business cycle, can stagnate or stimulate the development of the economy and business, respectively.

Methodological aspects of the research

The author assumes that the local business environment is formed by several factors, with the utility system of municipalities determining its development. The state of the local business environment determines the dynamics of regional entrepreneurship and the development and structuring of regional business. National (regional) and local policies are important in this direction. In this regard, the main objective is to analyze and highlight the opportunities for structuring and regional business development based on national and local policies, including the utilities system developed by municipalities. The research is realized through the territorial and network approaches use which are complemented by analytical, descriptive, horological methods, factor, and situational analysis.

Theoretical framework

The analysis of the scientific literature reveals two main conceptual strands. One comprises authors who study regional entrepreneurship and the impact of the business environment on its dynamics. [1, 2, 3, 4, 5, 6] The other strand focuses on research related to the definition of regional business, the elucidation of regional business cycles and the nature and factors influencing the economic development of regions. [7, 8, 9, 10, 11]

Relevant to this study is the analysis of Guo, C Liu, Q Xie, and X Lin, who propose a model for assessing economic development at the national and regional levels. [12] Using their proposed model, the interrelationships among the factors that affect the economic development of regions can be analyzed (Fig. 1). The author adopts the proposed schematic expression of the factor conditioning of business environment, entrepreneurship factors, economic activity, natural conditions and resources, policy pursued, and many others.

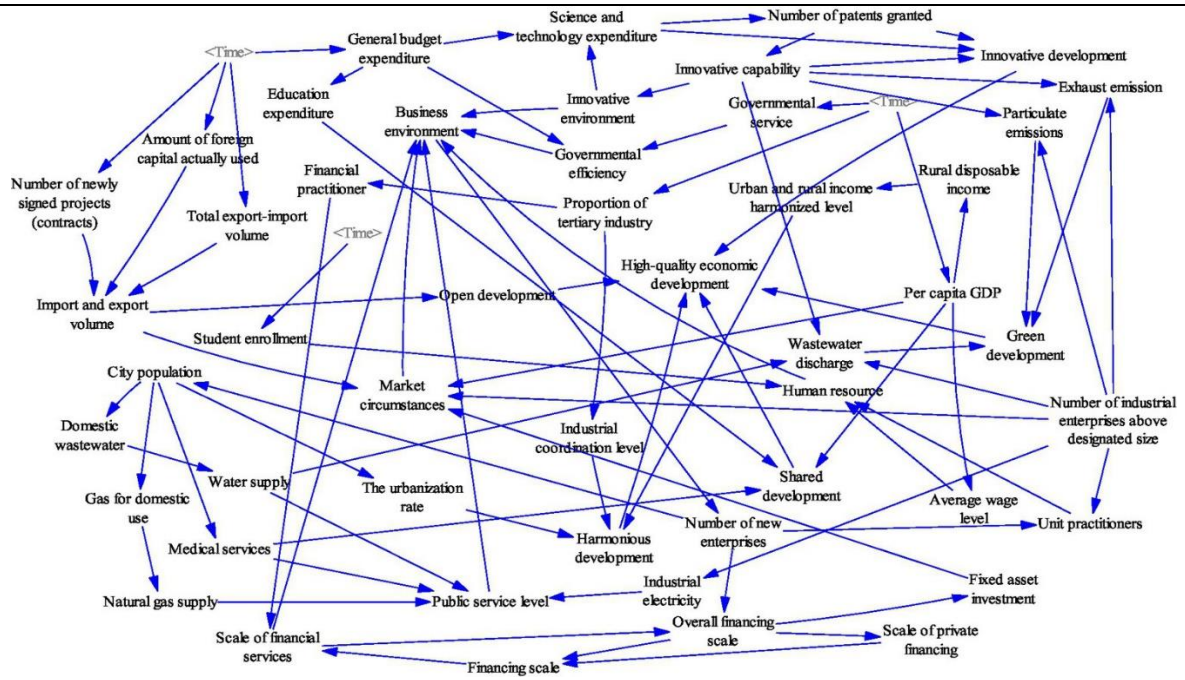

Fig. 1. General scheme of interrelations affecting economic development. Ex. C Guo, C Liu, Q Xie, X Lin.

Based on the model, the author proposes his view of the interrelationships of the various systems at the regional level, which is aimed at achieving regional sustainable and territorial development of the regions, as well as structuring the regional economy.

Regional business and utility systems in municipalities

There is a strong institutional and economic link among the state, municipalities, the national and regional environment, and firms. Speaking of regional business we refer to the municipalities functioning, and the regional environment formation. The development and existence of regional business concern the existence of regional business networks, industrial and other types of clusters, local initiative groups (LIGs), and the quality of services provided by municipalities (utilities). [13, 14] Indeed, at the regional level, we can identify and characterize the relationship between regional business and the utility system of municipalities. The management of municipal services, activities, and property (utilities) determines the quality of local government functioning and performance. The formation of the regional environment that frames regional business and its ability to develop and survive (especially in crises) depends on them. Ultimately, the existence and functioning of the regional economy determines regional business, i.e. the development of large, medium, and small firms within the boundaries of a specific region. Last but not least, an important factor in the economic process that influences firms and their vitality is the applied regional policy in its pure form, which also includes brands such as a change in the regionalization of Bulgaria's national space. [15, 16] It concerns not only the investment process in the regions but also the formation of a specific regional environment and regional incentives attracting firms.

The utilitie system includes the most important urban systems through which the management of cities (municipalities) shape the environment and conditions for the population and local firms (regional businesses). In this way, favorable conditions are created for them to exist and reproduce. In this context, local authorities carry out several basic activities and provide essential services to the local community and economic actors, without which their existence is unthinkable, including the urbanization of the territory.

The author proposes the following definition for the concept of utility system, namely they are a set of municipal activities and services. In this sense, there is a direct correlation between regional business and the utilities activities and services offered. The municipality utility system is designed to create and improve living and business conditions. Therefore, a key characteristic of basic activities and services is their public utility.

On the other hand, the utility of the utility system determines the quality of the environment and the attractiveness of the territory (municipality). A broader view shows that result-oriented local government is characterized by high public outcomes expressed in the socio-economic development of the respective municipality (city or territory). Positive changes in the general socio-economic condition of the territorial community are a consequence of the degree of utility and efficiency of the utilities activities and services performed and provided.

For the sake of clarity, it is necessary to introduce and clarify some basic concepts related to regional business, utilities activities and services, territorial development, urban and municipal governance, and regional development. Utility activities and services (the utilities system) are associated with municipalities. They are in turn characterised by territory, population, economy, and governance. The territory comprises the natural complex (ecosystem) and the urbanized (anthropogenic) regional environment. The territory, together with the population permanently settled on it, forms a territorial or local community. The economy

includes the economic actors, the market (population), and its governance.

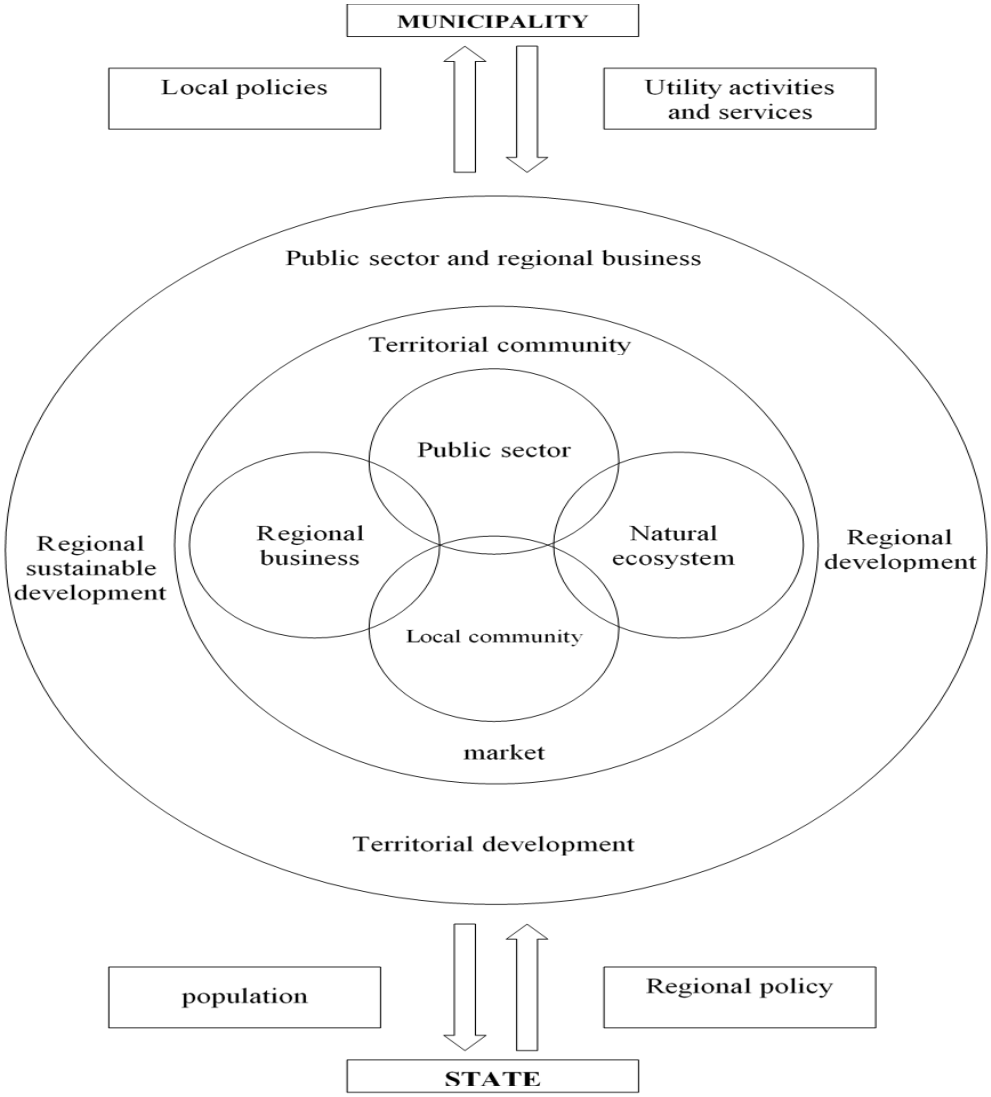

Fig. 2. Schematic expression of regional level inter-linkages in the context of regional development. Ex. Tsonkov, N., 2023.

The state and the administrative-territorial units (municipalities) influence the territory and the population (territorial communities) through local and regional policies. As a result of the policies implemented, the utility and efficiency of utility systems are shaping the regional environment. This local ecosystem changes in socio-economic terms, which is expressed in the process of territorial (regional) development (Figure 2). [17] The concept of "regional policy" is perceived as: "a system of normatively regulated documents and instruments aimed at the realization of regional development objectives in administrative-territorial units" (Article 4 of the Law on Regional Development). [18]

Regional policy or regional development policy supports and complements the utility systems of municipalities, as well as the implemented local initiatives and measures to improve the population's living conditions and stimulate regional business (Fig. 3) [17]

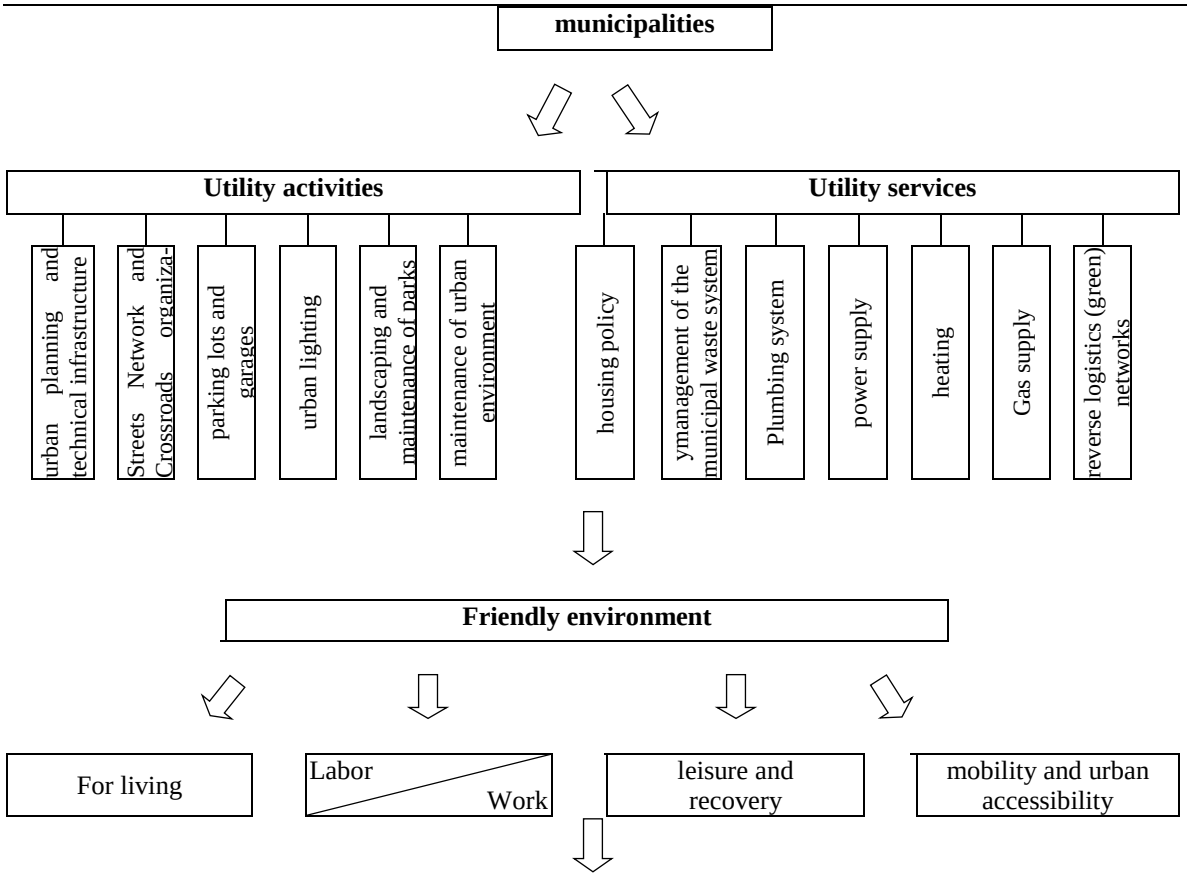

Fig. 3. Role of the municipality for territorial and regional development. Ex. Tsonkov, N. 2023.

Regional business is the formation of specific local socio-economic conditions, organizing and carrying out various types of economic activity for profit and to meet the needs of the local community, which together with other economic activities form the regional economy of a particular territory or municipality. That is to say, a regional business is the aggregate of all economic activities carried out within a regional economy that are distinctly regional and local. Regional businesses therefore interact with local communities on an ongoing basis. We could point to several examples of regional business. Typically these are activities that primarily serve the local population, including the wholesale and retail production and distribution of goods and food. Prominent examples of regional businesses are bakeries, which typically supply bread to the local market. Other examples are grocery stores, especially small neighborhood stores. Based on these examples, it is clear that regional businesses are mainly formed by micro, small, and less often medium-sized firms that tend to rely on local markets and cater to the needs of local communities.

On the other hand, regional businesses are strongly influenced by the local environment. The regional environment should be seen as the shaping of specific conditions based on local and national policies. To the specific conditions, we can include - local communities, features, nature, resources, political and legislative environment, economic situation, etc. The municipality, which provides the so-called basic services to the population (the local territorial community), is of great importance in shaping the regional environment. These services include utilities and public works, and services such as property management, transport, municipal waste, environmental infrastructure, green spaces and building stock, water supply, sewerage, electricity, gas supply, housing, urban planning, etc. The services and activities have a significant impact on the development of the territory of each municipality. The basic necessary conditions for the normal course of economic and demographic reproduction processes are developed. Through territory planning and organizing activities and infrastructure construction. At the same time, the last decades of transition have changed the nature and appearance of Bulgarian cities.

In broader macroeconomic terms, the concept of utility means the satisfaction of a person from the use of a good or the use of services. [19] The concept was first introduced by I. Bentham. [20] And here we see an intersection between the utility system and regional business because a purely economic product or service is useful when it achieves a certain level of satisfaction from its consumption. In this sense, we could speak of

expected and subjective utility (utility). In this way, we can define the expected utility outcome of public works and public utilities (the utility system of municipalities), which is expressed in better socio-economic conditions and increased attractiveness of the municipality.

Therefore, we can conclude that the utility system of the municipality is the set of public works and utilities that form the necessary basic conditions of the population and business for the normal reproduction of the specific territory, and satisfy their most important needs. In this sense, the utility system of activities and services (referred to as the utility system for short) is closely linked to the utility of the activities and services provided by the municipality. The needs that the municipality satisfies for the normal functioning of socio-economic processes in a specific territory are expressed by the degree of utility in the functioning of the municipality.

In Bulgaria, the state of the utilities system, and therefore the opportunities for structuring regional business, is at a very unsatisfactory level. As it is clear from Figure 4 the main problems in municipalities are demographic, economic, administrative, and infrastructure. [17] All this points to a non-functioning regional ecosystem, including the utility system of activities and services.

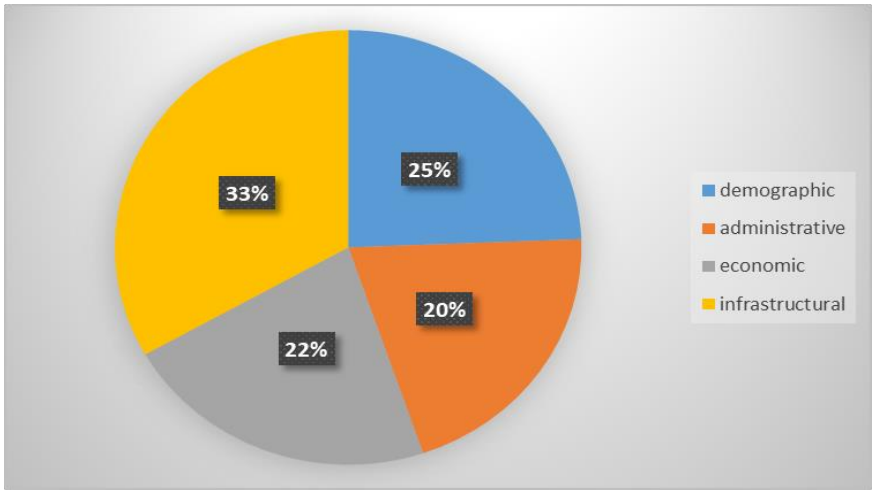

Fig. 4. The most significant problems in the Bulgarian municipalities. Ex. Author's research. Tsonkov, N., 2022.

Municipalities have an important place for regional development in Bulgaria which should form a favorable local business ecosystem. Therefore, the degree to which the utility system is established, complemented, and reinforced by regional and local policies, is very important.

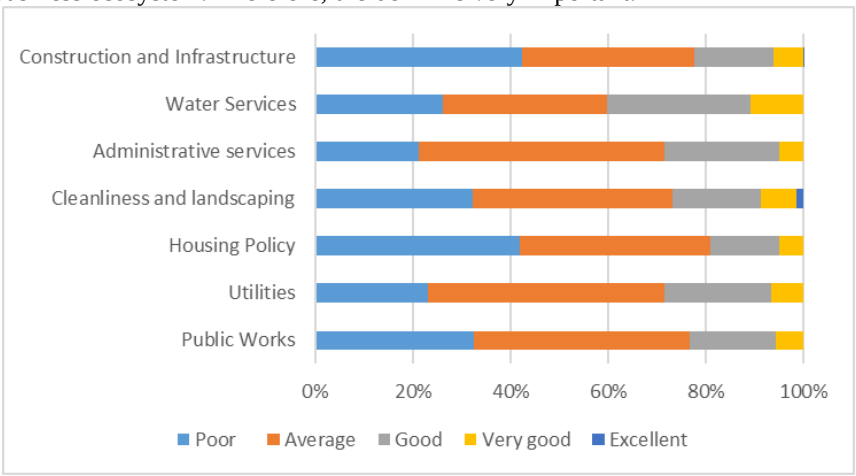

Fig. 5. Evaluation of the utility system by businesses and citizens. Ex. Author's research. Ex. Tsonkov, N. 2023.

From the author's research, it seems that businesses and citizens do not highly value the utility services and activities offered and provided (Figure 5). [17] Therefore, the role of the municipality and the state is to strengthen and develop the utility system and thus form a favorable environment for regional business, leading to regional sustainable and territorial development of the regions in Bulgaria. In a broader context, it is noted that as a result of the different conditions and basic services provided by municipalities, there are deep regional disparities in the Bulgarian state in territorial terms. [21] Therefore, it is necessary to think in the direction of developing and implementing a uniform standard of utility system of municipalities, to be guaranteed by the state budget through the subsidies received. this governance process requires the continuation of the decentralization process and autonomy of local government in Bulgaria.

Conclusion

In this study, the author attempted to analyze the theoretical aspects of regional business and the utilities system. On the one hand, regional business contributes to the socio-economic development of the territorial community and locality. On the other hand, with the implementation of regional and local policies, the local community and regional businesses are guaranteed to form the necessary conditions for reproduction and development through the utility services provision and the performance of activities that improve the quality of life and business development. The author's research shows that municipalities and the state do not provide the necessary basic conditions for the of territorial communities development and regional businesses. Therefore, there is a need for targeted impact on territories through the formulation and implementation of effective regional and local policies.

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TECHNICAL SCIENCES

APPLICATION OF BLOCKCHAIN IN IT INFRASTRUCTURE MANAGEMENT: NEW OPPORTUNITIES FOR SECURITY ASSURANCE

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Abstract

This article explores the application of blockchain technologies (BT) in managing IT infrastructure projects with the aim of enhancing security levels. It examines the potential of blockchain to ensure data protection, access control, and process automation through decentralized structures and immutable records. It is noted that the use of smart contracts and cryptographic methods can minimize the risks of cyberattacks and data leaks, while ensuring transparency and network resilience. The successful integration of blockchain solutions to optimize processes and improve IT system security is demonstrated through examples from companies like IBM, Walmart, and JP Morgan. The article discusses the advantages and challenges of implementing blockchain in existing systems, highlighting the necessity of a comprehensive approach and strategic planning for successful integration.

Keywords: blockchain, IT infrastructure, security, decentralization, smart contracts, data protection, automation.

Introduction

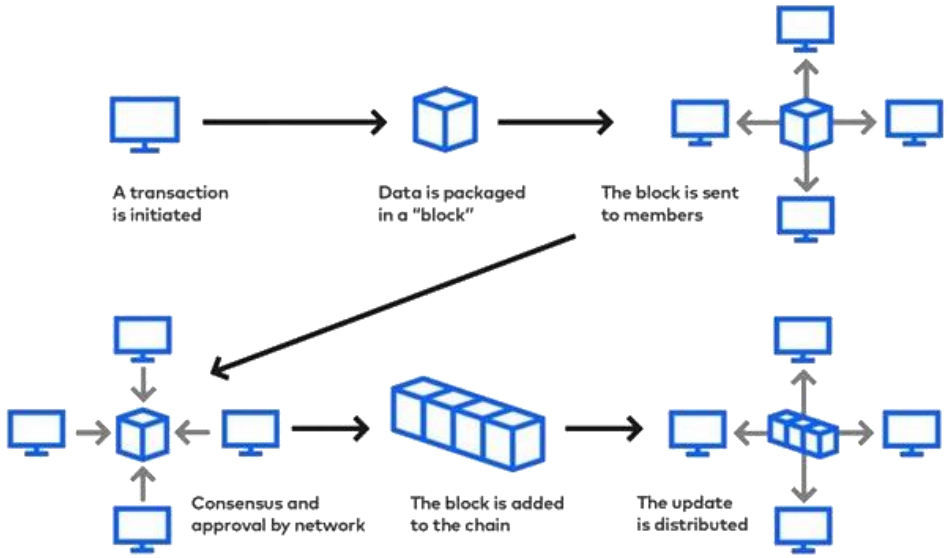
In the context of the rapid development of information technology and the increase in data volumes, the project IT infrastructure management is becoming an increasingly complex and vulnerable task. Traditional methods of ensuring the security of IT systems face challenges such as cyberattacks, data breaches, and integrity violations. In such circumstances, the search for new, more reliable solutions to protect and manage IT infrastructure becomes an urgent task. One of the promising approaches is the use of blockchain technology.

Blockchain is a decentralized and distributed data ledger system that ensures their indisputability, transparency and protection from unauthorized access. It was originally developed for financial transactions. Blockchain is currently being used in various fields, including logistics, healthcare, and digital asset management.

The purpose of this article is to analyze the possibilities of using blockchain technologies (BT) in managing the IT infrastructure of projects in order to increase the level of security. The article discusses how blockchain can help solve current security problems, what advantages and problems are associated with its implementation, as well as how this technology can transform existing approaches to IT resource management.

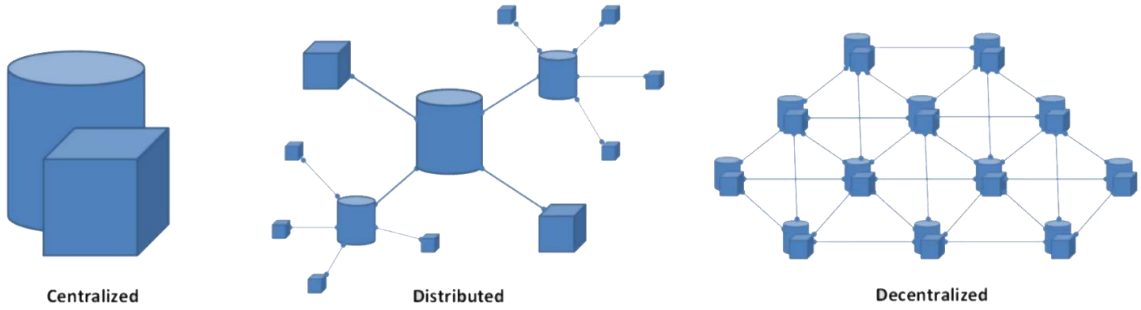
Main part. Principles of operation and advantages of blockchain technology

Blockchain is a distributed data storage system in which information is stored in a chain of blocks connected to each other using cryptographic methods [1]. Each block contains a unique timestamp and a reference to the previous block, ensuring the continuity and integrity of the entire chain (pic. 1).



Pic. 1. The scheme of operation of the blockchain technology

One of the main characteristics of the blockchain is **decentralization.** In traditional systems, data is controlled by a central server, which creates a «point of failure» and vulnerability to attacks. In the blockchain system, all nodes of the network are equal and distributed according to different geolocation. This structure not only enhances security by eliminating single points of failure but also increases transparency (pic. 2).



Pic. 2. Decentralization of blockchain technology

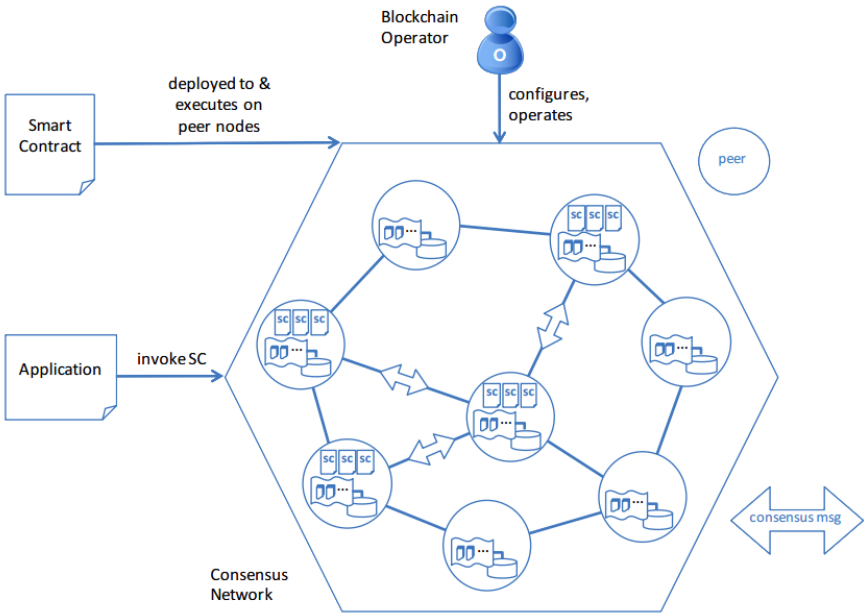
Every change, such as a new transaction or block creation, must be confirmed by a majority of network participants. This makes the blockchain more resilient to failures and hacks, because an attacker will need to attack most nodes at the same time. This is practically impossible on the scale of global networks [2]. The decentralization of the blockchain has an impact on the **management of configurations** and updates of IT systems. Blockchain allows you to store data in a distributed network, where all changes are recorded and verified by participants. This ensures that each developer sees only the actual information and can verify its authenticity.

According to Statista, the cost of blockchain solutions in 2024 will be $19 billion compared to $6.6 billion in 2021 [3]. This confirms the growing interest in BT as a way to manage data that helps companies minimize the risks of changing or destroying it.

Another principle is **transparency and immutability**. All transactions are recorded in a block and become part of a chain that is immutable and secured using cryptographic algorithms. This is especially important for banking and financial organizations. According to a Deloitte report, back in 2018, 68% of banks around the world believed that they would lose their competitive advantage if they did not implement blockchain technology [4].

The blockchain can be used to manage software updates. This ensures that each new version goes through the verification process and is distributed over the network in a secure way. This minimizes the risks associated with attacks during the upgrade phase and prevents the spread of vulnerable versions.

The blockchain works on the basis of **consensus**, that is, the general agreement of all network participants, according to which transactions are considered valid. This makes it possible to carry out decentralized confirmation of transactions and maintain the reliability of the system without the participation of a central authority (pic. 3).



Pic. 3. Blockchain consensus scheme

Common consensus mechanisms are Proof of Work (PoW) and Proof of Stake (PoS). In **PoW**, network nodes (miners) compete for the right to add a new block to the chain. This is determined by how quickly each element solves a cryptographic problem. The **PoS** mechanism works according to the principle of betting a certain number of coins on the network and selecting validators on this basis. PoS is characterized by lower energy consumption and higher operational efficiency [5].

Cryptography is an important component of data protection in the blockchain. Sophisticated algorithms are used to encrypt each transaction and block. This ensures that only authorized users can access the information. With this method of protection, hashing is used - the generation of a separate digital fingerprint.

Another unique aspect of the blockchain is the use of **smart contracts**. These software algorithms fulfill the terms of agreements between the parties without the use of intermediaries, which reduces the likelihood of fraud. Smart contracts allow you to automate various tasks, for example, financial transactions, digital asset management and verification of contract terms [6]. They offer a high level of trust and security, which makes them in demand in various industries such as financial services, logistics, real estate management and public administration.

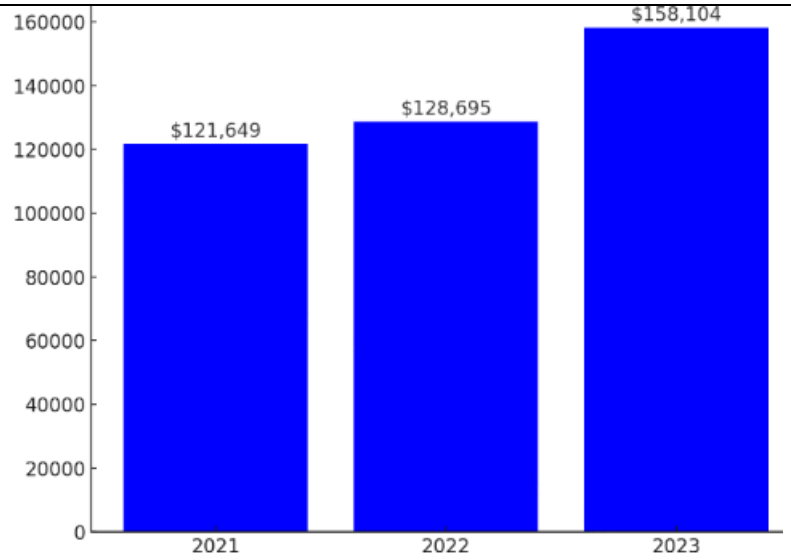
Examples of successful use of blockchain in the IT infrastructure

American companies are actively using BT to optimize and protect their IT infrastructure. This provides them with a competitive advantage and increases data security. IBM is a leader in this field. He develops blockchain solutions for supply chain management. IBM's Hyperledger Fabric-based blockchain platform is used, for example, in the IBM Food Trust project. It allows you to track food products at all stages of the supply chain – from the manufacturer to the end consumer. According to reports, the productivity of developers using Hyperledger Fabric has increased by 18%. At the same time, the cost of operations has decreased by 30% over three years of use, and unplanned downtime is eliminated 44% faster [7].

Walmart uses blockchain to monitor the quality and origin of products in its supply chain. In collaboration with IBM, the company has integrated the IBM Food Trust product tracking solution, which allows you to instantly check the history of products at all stages, from production to delivery to the store. This helps Walmart respond quickly to various incidents, such as the appearance of substandard goods, and eliminate possible disruptions in the supply chain.

Another example of successful use of blockchain is **Microsoft**. The company has implemented the Azure blockchain platform to integrate blockchain solutions using smart contracts. Azure supports both private and public blockchain networks. This provides customers with the opportunity to automate and improve processes.

JP Morgan, a large financial company, has made a significant step in the development of BT with the help of its Onyx platform. In 2023, up to $2 billion in transactions were processed daily using this technology. This contributed to an increase in JP Morgan's operational efficiency and cost reduction, which had a positive impact on the company's profitability (pic. 4).



Pic. 4. Total net revenue of JP Morgan, million dollars [8]

One of the key products of the Onyx platform is JPM Coin, a digital currency backed by a bank that allows instant settlements between institutional clients. Onyx has also developed a blockchain-based Link network to optimize cross-border payments and improve information exchange between participating banks. These initiatives highlight JP Morgan's commitment to integrate cutting-edge technology into its financial ecosystem, making it a leader in blockchain adoption in the banking industry.

Features of using BT in IT infrastructure management

Blockchain have become increasingly popular in recent years and are widely used in IT infrastructure management, offering diverse and innovative opportunities to significantly increase the level of security, ensure transparency of all processes and increase the stability and reliability of systems. However, the implementation and integration of this complex mechanism faces many challenges and difficulties that require careful analysis and elaboration in order to effectively solve them (table 1).

Table 1

Features of implementing BT [9]

Problem	Description	Solution
High implementation costs	Implementing blockchain requires significant financial and technical resources for adapting existing infrastructure and training personnel.	Piloting projects are recommended to assess the effectiveness and optimize costs; the use of ready-made infrastructure platforms can reduce setup and training expenses.
Integration complexity	Existing IT systems may be incompatible with blockchain platforms, complicating their integration and data synchronization.	The use of hybrid blockchain solutions, which allow existing systems to interact, and the development of APIs for data exchange between platforms.
Low scalability	Some blockchain platforms, especially public ones, face scalability issues that limit their performance and effectiveness for large data volumes.	The use of private or semi-private platforms and the choice of consensus algorithms (e.g., Proof of Stake) that provide higher transaction speeds.
Lack of qualified specialists	Implementing blockchain requires specialists with technical expertise and blockchain knowledge, which can become a challenge for many organizations.	Investment in education and training: offering courses for employees, attracting experienced consultants, and collaborating with companies specializing in blockchain technology.
Regulatory and legal barriers	There is a lack of clear regulatory frameworks for BT, which creates uncertainty for organizations, especially in areas related to data confidentiality.	Participation in blockchain standardization initiatives and collaboration with regulatory bodies to establish transparent legal frameworks for ensuring data confidentiality and compliance.
Complexity of management and updates	The decentralized nature of blockchain networks can complicate configuration management and software updates.	The use of smart contracts, which help automate certain management processes, and detailed documentation can reduce the risk of errors during configuration and updates.

The implementation of BT in the management of IT infrastructure requires an integrated approach and strategic planning. Developers must take into account technical, organizational, legal and economic aspects. To do this, it is necessary to develop comprehensive strategies with the involvement of relevant experts. Infrastructure adaptation and staff training can contribute to the successful development of projects, establish interaction with regulators and partners. This will minimize potential risks and costs, and maximize the benefits of new technologies.

Prospects for blockchain application in future IT infrastructures

The development of artificial intelligence (AI) and other new technologies, such as the Internet of Things (IoT), is affecting the blockchain. As noted above, the decentralized and transparent architecture of this technology allows for the security of complex projects. This is also used in AI systems. Thus, AI mechanisms often require training based on significant amounts of data. In this case, special attention to cybersecurity is required. Blockchain allows reliable and transparent data management, ensuring their integrity and protection from unauthorized access [10]. In addition, decentralized data storage in blockchain networks helps to minimize the risks associated with «points of failure». This is important for systems such as autonomous vehicles or medical devices.

The integration of blockchain with IoT also opens up new possibilities. Modern IoT devices generate a huge amount of data. There is a need to ensure their safety and proper use. The blockchain can be used to authenticate devices and encrypt data. This will help to ensure their protection at all stages of processing. For example, in smart cities, blockchain can become the basis for managing energy, transport systems and other resources.

Thus, the prospects for using blockchain in future IT infrastructures look promising. In combination with AI and IoT, blockchain can become part of new technological ecosystems. This will provide the transparency, security and adaptability needed to create sustainable and high-performance digital solutions.

Conclusion

The use of BT in IT infrastructure project management opens up new horizons in data security and process management. The decentralized structure of the blockchain and its immutability help to minimize the risks associated with cyber-attacks and data leaks. This is because each member of the network has access to the current version of the information and participates in the confirmation of changes. This increases the resilience of the infrastructure to internal and external threats. In addition, the blockchain ensures transparency of all transactions. This is important for monitoring and auditing IT systems. The integration of smart contracts automates access and update management, which reduces the likelihood of human error and increases data processing efficiency. As a result, blockchain enhances both security and transparency, but also contributes to the creation of more sustainable and flexible IT ecosystems that are able to adaptive IT ecosystems capable of meeting modern cybersecurity challenges and business needs.

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THE IMPACT OF SMART HOMES ON THE LIVES OF PEOPLE WITH PHYSICAL DISABILITIES

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Abstract

This article explores the impact of smart home technologies on the lives of individuals with physical disabilities, focusing on the ways these innovations enhance independence, safety, and social interaction. The article outlines several key advantages of smart homes, such as increased autonomy through voice-activated controls, improved safety via sensors and emergency alerts, and reduced social isolation through communication technologies. Additionally, the article highlights the benefits of automation in daily tasks and health monitoring systems that contribute to better health management[3].

On the other hand, the article also addresses the challenges faced by disabled users, including high initial costs, complexity in system setup and use, and the risks of over-reliance on technology. Concerns over privacy and security are also discussed, along with the need for ongoing maintenance and technical support. To overcome these challenges, the article suggests solutions like making smart home systems more affordable and user-friendly, implementing robust backup systems, and strengthening privacy protections.

The article argues that while smart homes offer significant benefits, further innovation and support—such as government incentives, improved customer service, and the integration of AI—are necessary to ensure these technologies are accessible and reliable for individuals with physical disabilities, ultimately enhancing their quality of life.

Smart home technologies have significantly impacted the lives of physically disabled people by providing enhanced independence, safety, and social interaction. However, despite the many benefits, there are also challenges and disadvantages associated with their use. This section will explore the advantages and disadvantages of smart homes for individuals with physical disabilities and offer suggestions for improvements to maximize the benefits while minimizing the downsides[2,3].

Keywords: smart systems, sensors, electronic systems, automation, smart transformation

Advantages of Smart Homes for People with Physical Disabilities

1. Increased Independence

Smart homes allow individuals with physical disabilities to control various devices in their homes, such as lighting, appliances, and security systems, through voice commands or mobile apps. This increases their autonomy and reduces the need for assistance with everyday tasks.

2. Improved Safety

Smart homes are equipped with sensors, cameras, and emergency alert systems that provide real-time monitoring of the home. These technologies help detect hazards like fire, gas leaks, or falls, ensuring prompt responses to emergencies. This improves the safety of disabled individuals and offers peace of mind to caregivers and family members.

3. Automation of Daily Tasks

Automated systems in smart homes simplify routine activities such as cooking, cleaning, and controlling the environment (e.g., temperature and lighting). This reduces the physical effort required by disabled individuals, allowing them to perform tasks independently without needing external help.

4. Health Monitoring

Wearable devices and integrated health systems in smart homes can monitor vital signs and send real-time health updates to caregivers or healthcare providers. This allows for better long-term health management and quick responses in case of medical emergencies.

5. Social Interaction

Smart home technology helps reduce social isolation by enabling communication with family and friends through voice-activated video calls, messaging, and virtual social platforms. This increases social integration and promotes emotional well-being[1,4].

Disadvantages of Smart Homes for People with Physical Disabilities

1. High Initial Costs

One of the significant drawbacks of smart home technology is its high initial cost. Installing smart systems, especially customized solutions for disabled individuals, can be expensive. This may be unaffordable for some disabled people or their families, limiting access to the benefits of these technologies.

2. Complexity and Learning Curve

Smart home systems can be complex to set up and operate, especially for individuals unfamiliar with technology. Individuals with physical disabilities might struggle with learning how to control these devices, particularly if they have cognitive impairments or limited access to technical support.

3. Reliance on Technology

While smart homes provide numerous benefits, there is also a risk of over-reliance on technology. In the event of a system malfunction or power outage, disabled individuals may find themselves unable to perform basic tasks. This can lead to feelings of helplessness if backup systems or alternatives are not available.

4. Privacy and Security Concerns

The use of interconnected devices in smart homes raises concerns about data privacy and security. Hackers could potentially access sensitive information or compromise home security systems, making individuals with physical disabilities vulnerable to cyber threats.

5. Maintenance and Technical Support

Smart home systems require ongoing maintenance and technical support to function optimally. Individuals with physical disabilities may face challenges in managing system updates, repairs, or troubleshooting problems without the assistance of a professional[3].

Suggested Improvements to Enhance the Performance and Advantages of Smart Homes

1. Affordability and Accessibility individuals with physical disabilities, governments, healthcare organizations, or NGOs could introduce subsidies, grants, or low-interest financing options. This would help reduce the cost barrier and make smart homes affordable to a wider range of individuals.

2. User-Friendly Interfaces

Manufacturers should focus on developing more user-friendly interfaces that are intuitive and simple to operate. For example, systems that rely heavily on voice commands or have large, easy-to-navigate visual controls would reduce the complexity for users who may not be tech-savvy.

3. Robust Backup Systems

One way to mitigate the risk of over-reliance on technology is by incorporating reliable backup systems. For instance, smart homes could have backup power sources (like battery packs or generators) that ensure critical systems, such as emergency alarms or medical devices, continue to operate during power outages.

4. Enhanced Privacy and Security Measures

Developers of smart home systems should prioritize cybersecurity by encrypting data transmissions and using multi-factor authentication. Regular security updates and alerts about potential vulnerabilities can help protect users from unauthorized access or hacking attempts.

5. Comprehensive Technical Support and Training

Many of the issues surrounding the complexity of smart homes can be resolved with proper support. Companies offering smart home solutions could provide on-site or remote technical training for users, as well as ongoing support. This would ensure that people with physical disabilities can manage their systems confidently without depending on external help[4].

Suggested Improvements to Address Disadvantages or Potential Problems

1. Over-Dependence on Smart Homes

While smart homes provide autonomy, there is a risk of individuals becoming overly dependent on the technology. To counter this, it's essential to promote balanced usage and have alternative solutions in place. For example, individuals should still practice basic life skills and maintain a network of personal support for emergencies. Caregivers or family members can check in periodically to ensure that the individual remains connected to human assistance when necessary.

2. Improved Customer Support Channels

Many users might experience issues with maintenance or malfunction of devices. Creating a more responsive, accessible, and empathetic customer service experience would minimize frustrations. Companies could offer accessible troubleshooting guides specifically designed for disabled individuals, such as videos or easy-to-read manuals, along with a dedicated helpline for immediate technical support.

3. Modular and Customizable Smart Home Systems

Offering modular smart home systems could allow users to start with essential features and expand their systems as needed. This would lower the initial investment and make it easier for people with physical disabilities to prioritize the most critical aspects of their home. Over time, they could add more advanced features as their needs and budget allow.

4. Artificial Intelligence (AI) for Predictive Assistance

Incorporating AI in smart home systems could significantly improve the efficiency of daily operations. AI could learn the user's behavior patterns and automatically adjust the environment based on their preferences. For example, AI could detect when a user typically needs help in the kitchen or bathroom and proactively adjust the lighting or temperature. It could also predict potential hazards and automatically alert users and caregivers before incidents occur.

5. Government and Institutional Support

Governments and institutions could create more policies supporting the widespread adoption of smart homes for disabled individuals. This might include tax incentives for those installing smart home systems or providing public housing with built-in smart technologies designed to accommodate people with physical disabilities[5].

Conclusion

Smart homes offer incredible benefits for people with physical disabilities, including increased independence, improved safety, and better social integration. However, they also come with several challenges, such as high costs, complexity, and privacy concerns. By addressing these disadvantages through affordable options, user-friendly designs, and enhanced security measures, smart homes can become even more beneficial.

In the future, the integration of artificial intelligence, predictive assistance, and improved government support can further expand the advantages of smart homes while reducing their limitations. By making these technologies more accessible and reliable, people with physical disabilities can enjoy even greater independence and enhanced quality of life.

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ANALYSIS OF STRATEGIES FOR MOBILE OPTIMIZATION IN FRONTEND DEVELOPMENT

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Abstract
The article analyzes mobile optimization strategies in frontend development aimed at enhancing the performance and usability of mobile applications. It examines architectural approaches such as modular and microservices structures, as well as rendering methods (server-side and client-side) and their impact on load speed and interface responsiveness. Special attention is given to application state management methods, responsive design, and adherence to accessibility standards, which together improve the user experience for a wide audience.

Keywords: mobile optimization, frontend development, architecture, rendering, accessibility, performance.

Introduction

With the rise in popularity of mobile devices (MD) and increasing demands for speed and responsiveness in applications, optimizing the frontend architecture for mobile platforms has become one of the key tasks in web development. In an environment of high traffic and limited resources on MD, factors such as performance and accessibility are critically important for ensuring a positive user experience (UX) and the competitiveness of a product in the market.

However, optimizing frontend applications for MD faces a number of unique challenges, including low network bandwidth, limited computing resources, and the high susceptibility of mobile users to unpredictable network conditions. Traditional web development approaches focused on desktop devices often fail to perform adequately in a mobile environment, necessitating new architectural solutions and optimization strategies.

The aim of this work is to investigate architectural approaches such as modularity and microservices architecture, as well as to study the application of rendering technologies like Server-Side Rendering (SSR) and Client-Side Rendering (CSR) in high-load mobile applications. It is hypothesized that a combination of architectural and technological strategies will achieve high performance and provide a high level of accessibility.

Main part. Analysis of architectural approaches in high-load mobile applications

One of the key aspects of effective mobile optimization is the **proper choice of architecture** for the frontend application, which is especially relevant for high-load applications. Modern approaches in mobile frontend development offer two main architectural strategies: modular and microservices architectures.

Modular architecture allows an application to be divided into independent components, simplifying maintenance and improving loading speed due to the possibility of parallel rendering of various modules. This architecture also provides the ability for selective loading of necessary resources, which is especially important under mobile constraints [1].

On the other hand, **microservices architecture** implies the division of an application into small independent services that can be deployed and updated independently of each other. This allows for flexible load management and improves response time, as each service operates autonomously, reducing the overall amount of data transferred to the device. The combination of modular and microservices architectures in high-load applications enables faster loading and minimizes the volume of data transmitted over the network. This is particularly important for MD, as limited resources require more efficient load distribution. The microservices approach allows for the application of various strategies to optimize interface rendering and resource allocation, particularly when using **SSR** and **CSR** [2, 3].

The SSR method offers rendering of the application on the **server-side** before sending the page to the client device. When accessing the application, the server processes the request and returns a fully formed HTML page with complete content, which is displayed on the user's screen. This approach allows users to see fully loaded content faster, as the main data processing is performed by the server, reducing the load on the mobile device.

However, SSR also has its drawbacks. The primary disadvantage is the increased load on the server, as each new request requires separate page generation. In high-load applications, this can lead to increased server response times and reduced overall system performance. To circumvent this limitation, hybrid approaches are sometimes used, such as pre-rendering frequently visited pages, which reduces the need for SSR for every request.

In contrast, the **CSR method** assumes that content rendering occurs directly on the client-side. In this case, the server sends a minimal HTML structure with the necessary script links, while all content rendering is performed by the browser after receiving and executing JavaScript. In CSR applications, data is dynamically loaded and processed on the client side, ensuring a smoother transition between pages and enhancing the interactivity of the application [4].

However, CSR also has its drawbacks. One of the main disadvantages is the time to interactive (TTI), which increases as time is required to load and execute JavaScript on the client. This can lead users to see a blank screen or partially loaded content until all necessary scripts have finished loading, which degrades the UX. CSR is also less effective for Search Engine Optimization (SEO), as search engine crawlers may not wait for the full loading of JavaScript to index content, potentially reducing the visibility of the application in search engines.

The choice between SSR and CSR depends on the application's tasks and the target audience's preferences. A combined approach known as **hybrid rendering** allows for leveraging the advantages of both strategies. For instance, SSR can be used for the initial page rendering (which improves loading time and SEO), while CSR can be used for loading and updating subsequent interface elements, enhancing interactivity.

In addition to hybrid rendering, there are many other strategies for optimizing the performance of mobile applications. The main ones include **code splitting**, **asynchronous resource loading**, and **graphics optimization** [5]. These methods aim to minimize loading time and improve interface performance.

One popular strategy for mobile optimization is **code splitting**, which allows for loading only the modules necessary at a particular stage of application use. For example, for the main screen, only the core functionality can be loaded, while additional modules are asynchronously loaded as needed. This approach helps significantly reduce the initial loading time, positively impacting the UX.

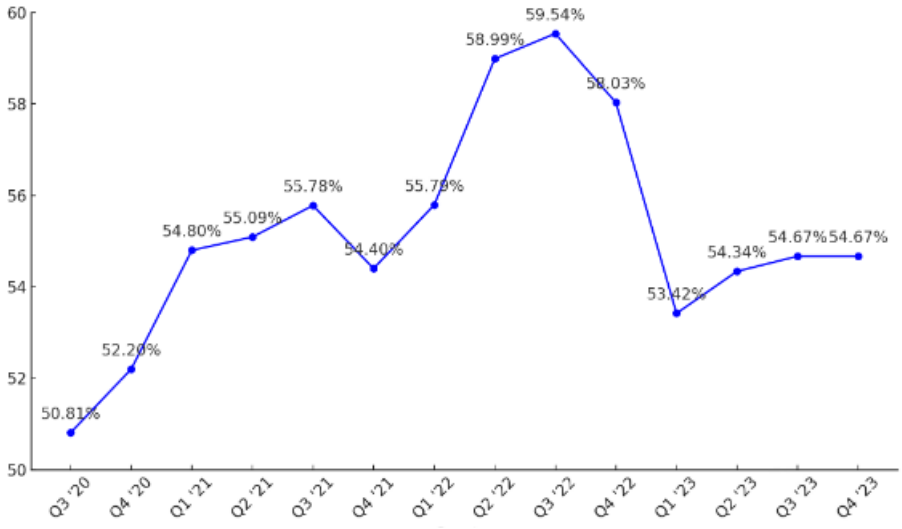
Asynchronous loading also allows for optimizing resource loading and avoiding blocking the main thread, which is particularly important for heavy applications with high load. Asynchronous server requests are performed in parallel with the main application processes, helping to reduce the TTI and improve interface responsiveness.

To improve performance in mobile applications, it is important to optimize graphic resources. This includes images, videos, and other multimedia data, which account for a significant share of the total volume of downloaded data. The use of modern image formats such as WebP allows for a reduction in file sizes and faster loading. WebP provides improved compression compared to JPEG and PNG without significant loss of quality.

Another effective technique is **lazy loading**. This technique allows for loading images and other resources only when they actually come into the user's view. This helps conserve resources and improve performance by avoiding the excessive loading of data that may not be needed during user interaction with the application.

Improving responsiveness and optimizing UI in UX

Responsive design is an integral part of mobile optimization, as MD vary in screen sizes, resolutions, and orientations. Responsive design entails adapting the interface to various resolutions and pixel densities, ensuring usability on MD. It is important that the interface elements remain easy to navigate and interact with on any device [6]. Responsive design is particularly relevant in the context of the growing usage of MD. According to statistics for 2024, MD account for approximately 55% of internet traffic, with a full traffic change schedule presented in picture 1.



Pic. 1. Percentage of mobile device website traffic worldwide [7]

Application state management is a crucial aspect of mobile optimization. To maintain high performance, many developers use approaches such as **centralized state storage**, for example, **Redux** or **MobX** [8].

Redux is based on the principle of a **single source of truth**, where all application state is stored in a single state object (**store**). This state can only be modified by **dispatching actions,** which are handled by **reducers.** In Redux, data flows in one direction, simplifying the understanding of data flows and debugging. When the state is updated, components that depend on this state are automatically re-rendered. This approach is suitable for **large applications** with complex architecture, where state management requires explicit control and debugging.

In contrast, **MobX** uses a **reactive approach** to state management. It focuses on automatically updating components when data changes, without the need to explicitly dispatch actions or update the state. MobX employs an observer mechanism that automatically responds to state changes. This method is suitable for **small and medium applications** where fast and simple state management is required without a lot of configuration and **boilerplate code** (pre-written code or templates that can be used as a basis for creating new applications or components). Centralized state storage allows for managing state on the **client side** and minimizes the number of server requests, reducing network load and speeding up interactions.

The process of load testing and subsequent optimization of the mobile application is conducted with a focus on evaluating its performance under various conditions. Key performance metrics, essential for assessing the application's efficiency and responsiveness, are detailed in Table 1.

Table 1

Key performance metrics [9]

Metric	Description	Target value
Time to First Byte (TTFB)	Time until the first byte is received from the server.	< 200 ms
First Contentful Paint (FCP)	Time until the first content is rendered on the screen.	< 1 s
Largest Contentful Paint (LCP)	Time until the largest content element is loaded.	< 2.5 s
Cumulative Layout Shift (CLS)	Measures the visual stability of content on the screen.	< 0.1 s
Time to Interactive (TTI)	Time required for the page to become fully interactive.	< 5 s

The metrics in Table 1 provide a foundational basis for evaluating and enhancing the mobile application's performance and responsiveness. By aligning with these target values, the application can achieve faster load times, improved visual stability, and a smoother user experience. These benchmarks are instrumental in guiding the optimization process, ensuring the application meets the necessary standards for efficiency and user satisfaction under varying load conditions.

Performance and accessibility optimization is essential for developing interfaces that are both responsive and user-friendly, ensuring access to a broad and diverse audience. Optimizing performance metrics, such as load times and interactivity, has a direct impact on user experience, particularly for those on slower networks or using older devices. By reducing loading delays and improving content stability, developers can minimize user frustration and increase engagement. Additionally, optimized performance reduces resource consumption, which benefits both users and the environment by lowering data usage and energy demands.

Accessibility optimization complements performance improvements by supporting a wide range of users, including those with disabilities. This involves incorporating features such as screen reader compatibility, keyboard navigation, and adequate color contrast to make interfaces usable for individuals with various needs. Accessibility efforts go beyond regulatory compliance, reflecting a commitment to inclusive digital experiences.

Conclusion

Optimizing frontend architecture for mobile applications is essential in today's digital landscape, characterized by diverse device capabilities and user expectations. Employing architectural strategies like modular and microservices architectures, along with rendering techniques such as SSR and CSR, can significantly enhance performance and UX.

Additionally, integrating performance optimization strategies, responsive design, and accessibility standards fosters inclusivity and improves user engagement. As mobile internet traffic continues to rise, these approaches will be critical for developers aiming to create high-performing, responsive, and accessible mobile applications that meet the demands of a dynamic user base.

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BLOCKCHAIN-ENABLED SUPPLY CHAIN MANAGEMENT: IMPLICATIONS FOR THE LAND TRANSPORTATION SECTOR

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Abstract

Blockchain technology is effecting a transformation in land transportation, enhancing both the efficiency and security of supply chains. This paper delineates the principal attributes of blockchain technology, including decentralization, transparency, and security, and their ramifications for transportation systems. The integration of blockchain technology can enhance traceability, optimize operational efficiency, and cultivate trust among stakeholders while guaranteeing data integrity. It presents opportunities for regulatory compliance, cost reduction, and sustainability, particularly when integrated with IoT devices for enhanced monitoring. Nevertheless, obstacles such as technical complexities and regulatory ambiguities may impede the comprehensive adoption of this technology. Future research should concentrate on the practical implementation and scalability of blockchain technology, with the transportation sector assuming an active role in the development of applications that will facilitate more efficient and sustainable supply chains.

Keywords: blockchain, supply chain management, land transportation, decentralization, transparency, security, smart contracts

1. Introduction

Blockchain technology has evolved into a transformative force in the domain of land transportation, offering substantial potential for enhancing the efficiency and security of supply chains. The implementation of blockchain technology within land transportation frameworks has the potential to revolutionize supply chain management. It can offer enhanced traceability, increased efficiency through the use of smart contracts, and improved data security.

Blockchain technology has been the subject of investigation across sectors – finance technology, healthcare, and supply chain management. However, its applications in the field of land transportation remain in a relatively nascent state. Despite the growing interest in blockchain technology for land transportation, there is a deficiency of comprehensive research examining its conceptual characteristics and implications for the sector.

This paper aims to fill the knowledge deficiency by exploring the conceptual characteristics of blockchain technology and examining their implications for the land transportation sector.

The research question of the paper is: In what ways can blockchain technology improve efficiency and security within the land transportation supply chain?

The objective of this paper is to provide a comprehensive analysis of the potential applications of blockchain technology in land transportation and its implications for supply chain management.

The paper posits that the integration of blockchain technology in land transportation systems has the potential to revolutionize supply chain management. This would be achieved by enabling enhanced traceability, improved efficiency through smart contracts, and heightened data security.

2. Conceptual characteristics of blockchain technology: decentralization, transparency, and security

Blockchain technology represents a revolutionary advancement in digital data management, exhibiting a distinctive set of conceptual elements that differentiate it from traditional systems. In essence, blockchain functions as a decentralized and distributed ledger technology, ensuring data integrity through its immutable and transparent nature. This implies that once information is entered into the blockchain, it cannot be modified or erased, which greatly enhances the reliability of the data and the trust among users and stakeholders[1]. The blockchain's decentralized structure eliminates the necessity for a central authority, facilitating direct interactions between peers that enhance autonomy and provide greater control over data[2].

A principal attribute of blockchain technology is its transparency. Each transaction is recorded on a public ledger that can be accessed by all network participants. This not only encourages accountability but also enhances the ability to trace transactions[3]. The aforementioned clarity is of vital importance in a multitude of applications, including those pertaining to supply chain management. It can assist in the reduction of issues associated with information asymmetry and enhance operational efficiency[4]. Furthermore, the implementation of consensus mechanisms ensures that all participants concur on the veracity of transactions, thereby enhancing the reliability of the recorded data[2][5].

The security of data is a fundamental aspect of blockchain technology. The deployment of cryptographic techniques ensures the secure storage and transmission of data, preventing unauthorized access and modification[6]. This is particularly pertinent in sectors such as healthcare and finance, where the safeguarding of data privacy is of paramount importance[7]. Furthermore, the utilisation of smart contracts—self-executing agreements wherein the stipulations are integrated directly into the code—offers an additional layer of security and automation, enabling transactions that are more expedient and reliable[8].

In addition to these foundational characteristics, blockchain technology offers the crucial benefits of scalability and adaptability, which are essential for its integration across diverse sectors. As organizations increasingly seek to leverage blockchain for a spectrum of applications, including supply chain management and the Internet of Things (IoT), the capacity to expand solutions while maintaining performance and security is of paramount importance[9]. The ongoing evolution of blockchain technology, including the development of hybrid models that combine public and private blockchains, enhances its capacity to address complex challenges in a more effective and efficient manner[10][11].

The defining characteristics of blockchain technology—decentralization, transparency, security, and scalability—establish it as a transformative tool with the potential to revolutionize a multitude of industries. This is due to its capacity to enhance trust, optimize operational efficiency, and maintain data integrity. As research continues to examine the potential applications of blockchain technology, it is anticipated that its impact will continue to grow, fostering innovation and influencing the way conventional business practices are conducted[12][13][14].

Following an examination of the fundamental characteristics of blockchain technology, it is essential to investigate its practical applications within the land transportation industry. The implementation of blockchain technology in this sector presents a unique opportunity to address persistent challenges in supply chain management, particularly those related to efficiency and security. The land transportation sector has the potential to undergo a transformative shift through the harnessing of the decentralized, transparent, and secure qualities inherent to blockchain technology. This could result in the implementation of more efficient processes, a reduction in fraud, and enhanced traceability. The following section will examine the practical applications of blockchain technology in land transportation systems, with a particular focus on its impact on supply chain efficiency and security protocols.

3. Blockchain integration in land transportation: enhancing supply chain efficiency and security

The implementation of blockchain technology in land transportation, particularly in the context of supply chain management, presents a substantial opportunity to enhance efficiency, transparency, and security. The following paragraphs delineate the various methods through which blockchain technology can be integrated into land transportation systems, with a particular focus on its applications in supply chain management.

Enhanced traceability and transparency

Blockchain technology offers a decentralized and immutable record that enhances traceability and transparency throughout the supply chain. This feature is of particular importance in the context of land transportation, where goods can be tracked in real time. By recording each transaction and movement on a blockchain, all stakeholders can access a single, authoritative source of information regarding the status and location of shipments. This reduces the likelihood of discrepancies and fosters trust among participants in the supply chain[15][16][17]. For example, the capacity to trace the origin of products can significantly reduce the probability of fraud and theft, as all transactions are meticulously documented and subject to continuous review[18][19].

Improved efficiency through smart contracts

Self-executing agreements, otherwise known as smart contracts, have their terms embedded in code, thereby enabling the automation of a multitude of processes within the domain of land transportation. The implementation of smart contracts on a blockchain enables transportation firms to enhance their operational efficiency, including the automation of payment processing, shipment tracking, and compliance management[20]. Upon arrival of a shipment at its destination, the smart contract can automatically initiate payment to the carrier, thereby reducing delays and administrative burdens[21][22]. The implementation of automation facilitates the expeditious completion of transactions while concomitantly diminishing the probability of human error, thereby engendering more reliable operational outcomes[23].

Enhanced security and data integrity

The cryptographic features of blockchain technology ensure the security and integrity of the data stored within the system, preventing any form of tampering or alteration. This is particularly crucial in the context of land transportation, where the confidentiality and integrity of data pertaining to shipments, including details such as ownership and condition, must be protected against unauthorized access and modifications[24][25]. Blockchain technology provides transportation firms with a means of safeguarding their data from cyber threats and ensuring that all stakeholders have access to accurate and up-to-date information[26]. The enhanced security measures may enhance confidence among stakeholders, thereby fostering more robust collaborative relationships throughout the supply chain[27][28].

Streamlined regulatory compliance

Compliance with regulations represents a pivotal concern within the transportation sector, particularly with regard to safety protocols and environmental legislation. Blockchain technology can facilitate compliance by providing a transparent and immutable record of all transactions and procedures pertaining to the transportation of goods. [29]. This feature allows businesses to demonstrate their compliance with regulations with minimal effort, as all necessary documentation can be stored on the blockchain and made available to regulatory authorities in real-time[30][31]. Furthermore, the ability to rapidly retrieve historical data can streamline the auditing and inspection processes, reducing the time and resources required for compliance management[32].

Improved collaboration and coordination

Blockchain technology facilitates collaboration among diverse participants in the supply chain, including manufacturers, carriers, and retailers. Blockchain provides a unified platform for data sharing, enabling all stakeholders to access consistent information, thereby enhancing coordination and decision-making[33][34]. To illustrate, the ability to monitor the status of shipments in real time can facilitate more efficient inventory management and enhance logistics processes for businesses[35]. This collaborative approach

to problem-solving can lead to reduced lead times, lower costs, and greater customer satisfaction. It allows stakeholders to respond more effectively to changes in demand or disruptions in the supply chain[36].

Cost reduction

The implementation of blockchain technology has the potential to significantly reduce the costs associated with land transportation. By reducing the necessity for intermediaries and manual processes, businesses can diminish the expenses associated with logistics management[37]. Furthermore, the enhanced efficiency and precision offered by blockchain can mitigate delays and losses, which contributes to a reduction in costs[38]. The potential for reduced insurance premiums as a consequence of enhanced security and diminished fraud risk also represents a financial advantage for businesses that adopt blockchain solutions[39][40].

Sustainability and environmental impact

Blockchain technology has the potential to significantly enhance sustainability in the supply chain by providing improved tracking of carbon emissions and adherence to environmental regulations. By recording the environmental impact of transportation activities on the blockchain, businesses can gain insights into their sustainability performance and identify areas for improvement[41]. Such transparency can also enhance corporate social responsibility initiatives, as stakeholders are increasingly demanding accountability for environmental practices[42][43][44]. Furthermore, blockchain technology can facilitate the observation of sustainable practices throughout the supply chain, ensuring that all parties adhere to the established standards[45][46].

Integration with IoT for enhanced monitoring

The integration of blockchain technology and Internet of Things (IoT) devices has the potential to markedly enhance the efficacy of monitoring functions in land transportation. Internet of Things (IoT) sensors have the capacity to gather real-time data on a range of factors, including temperature, humidity, and location. This data can then be securely stored on the blockchain[20][43]. This approach allows for the proactive monitoring of shipments, particularly those containing items that require special handling, such as pharmaceuticals and perishable goods[32][47]. The integration of IoT data into a blockchain enables businesses to ensure that products are delivered under optimal conditions, thereby reducing waste and enhancing quality[48].

Facilitating Cross-Border Trade

Blockchain technology has the potential to facilitate cross-border trade in a more efficient and expedient manner by providing a secure and transparent platform for the recording of transactions and adherence to international regulatory standards[21]. The implementation of blockchain technology can facilitate the simplification of customs clearance and regulatory approvals processes by streamlining documentation and automating procedures through the use of smart contracts[23]. This functionality not only facilitates the expeditious transfer of products between countries but also enhances confidence among global trading partners, as all parties can confirm the legitimacy and adherence of the shipments[22][49].

Future trends and innovations

As blockchain technology continues to evolve, it is anticipated that its applications in land transportation and supply chain management will expand. The advent of permissioned blockchains and the integration of artificial intelligence with blockchain systems may potentially enhance the efficacy of supply chain management[34][50]. Furthermore, ongoing research on the scaling and interoperability of blockchain technology is anticipated to address existing limitations, thereby enhancing its applicability for a broader range of uses within the transportation sector[16][51]. Blockchain's capacity to facilitate innovative solutions, including the implementation of decentralized logistics systems and enhanced data sharing, establishes it as a pivotal element in the prospective advancement of land transportation[17][31].

In light of this investigation into the prospective influence of blockchain technology on land transportation systems and supply chain management, it is imperative to integrate our findings and contemplate their far-reaching implications. The following section will provide a synthesis of the key insights from this study, evaluate the significance of blockchain integration in the land transportation sector, and propose future directions for research and implementation.

4. Conclusion

The incorporation of blockchain technology into land transportation systems and supply chain management offers considerable promise for a radical transformation of the industry. This study has identified several key benefits, including enhanced transparency, improved traceability, increased security, and streamlined processes. By capitalizing on the decentralized and immutable nature of blockchain technology, stakeholders can enhance trust, efficiency, and cost-effectiveness throughout the supply chain.

The research findings illustrate that blockchain implementation can effectively address longstanding challenges in land transportation, including fraud prevention, real-time tracking, and seamless information sharing among multiple parties. These improvements have the potential to optimize logistics operations, reduce delays, and minimize errors, thereby increasing customer satisfaction[52] and conferring a competitive advantage on businesses that adopt this technology.

Nevertheless, it is crucial to recognize that the extensive implementation of blockchain technology in land transportation systems is confronted with a multitude of challenges. These include technical challenges, regulatory uncertainties, and the necessity for standardization across the industry[53]. To surmount these obstacles, it will be necessary for a number of stakeholders, including technology providers, transportation companies, government agencies, and academic institutions[54][55], to engage in collaborative endeavours.

Future research should concentrate on the development of practical implementation strategies, the resolution of scalability issues, and the investigation of the integration of blockchain with other emerging technologies[56][54], including the Internet of Things (IoT) and artificial intelligence. Moreover, the implementation of pilot projects and case studies across diverse transportation modes and supply chain scenarios will facilitate the acquisition of invaluable insights into the

practical applicability and advantages of blockchain technology in real-world contexts.

In conclusion, while blockchain technology demonstrates considerable potential for transforming land transportation systems and supply chain management, its full potential remains unrealized. As the technology continues to evolve and mature, it is of the utmost importance for industry leaders and policymakers to remain informed about its developments and to actively participate in shaping its future applications. By embracing the capabilities of blockchain technology and addressing the challenges associated with its implementation, the land transportation sector can facilitate the development of a more efficient, secure, and sustainable future in supply chain management.

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BLOCKCHAIN TECHNOLOGY IN MARITIME OPERATIONAL RISK MANAGEMENT: INNOVATIVE APPROACHES AND SOLUTIONS

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Abstract

The maritime transport sector is confronted with a multitude of operational risks that demand the implementation of efficacious management strategies. It is often the case that traditional frameworks prove inadequate, particularly in the context of integrating innovative technologies such as blockchain. This research underscores the potential of blockchain technology to mitigate the aforementioned risks by addressing challenges such as inefficiencies in documentation, a lack of transparency, security vulnerabilities, and regulatory compliance issues. Blockchain offers a decentralized, immutable ledger that facilitates documentation, reduces errors, prevents fraud, and enhances transparency and traceability. This encourages more effective collaboration among stakeholders and enhances security measures, particularly in the context of cybersecurity. Furthermore, it facilitates regulatory compliance through transparent record-keeping and automated reporting via smart contracts. While blockchain technology has the potential to optimize supply chain management and enhance data analytics for proactive risk management, the successful implementation of such solutions requires the collaboration of industry stakeholders, regulatory support, and ongoing innovation. Further research should investigate the scalability of blockchain technology, its integration with other digital technologies, its long-term impact, and the establishment of standardized protocols. The complete potential of blockchain technology in the management of maritime operational risks has yet to be fully actualized.

Keywords: blockchain, maritime, operational risk management, innovative approaches, risk mitigation, safety, supply chain, data analytics, regulatory compliance

1. Introduction

The maritime transportation industry is confronted with a multitude of operational hazards that necessitate the implementation of robust risk management strategies. The importance of this subject is derived from the necessity for effective risk management systems to ensure the safety of crew members, safe navigation, and environmental protection within the maritime transport industry.

The extant literature on operational risk management within the maritime transport industry has primarily focused on conventional frameworks and technologies, with relatively little attention devoted to innovative technologies such as blockchain. There is a dearth of knowledge regarding the integration of novel technologies, such as blockchain, to enhance operational safety and mitigate risks within the maritime transport sector.

The rationale behind this research is to explore the potential of blockchain technology in addressing the challenges of navigating maritime operational risks and to identify the innovative approaches that can be adopted in risk management strategies.

The article's research question can be stated as follows: What novel approaches might blockchain technology offer for mitigating operational risks in the maritime transportation industry? The aim of this research is to investigate the potential of blockchain technology in enhancing operational risk management frameworks in the maritime transport sector.

The author's hypothesis postulates that integrating blockchain technology into the operational risk management frameworks utilized in the maritime industry can facilitate the development of innovative strategies aimed at reducing risks and enhancing safety in maritime transportation.

2. Navigating challenges in maritime operational risk

It is of paramount importance to mitigate operational risk in maritime transport, given the multitude of risks inherent to maritime activities[1][2][3][4]. These risks encompass safety concerns for crew members and passengers, environmental hazards, and the security of cargo[1][2]. The maritime sector is inherently dangerous, with safety standards situated between those of air and road transport. This necessitates the implementation of robust risk management strategies to safeguard the wellbeing of personnel and the integrity of the marine ecosystem[1][5][6].

The establishment of operational risk management (ORM) frameworks is of paramount importance for the identification, assessment, and mitigation of risks associated with maritime activities. ORM employs a structured method that addresses various elements, including the safety of the crew, the safety of navigation, and the conservation of the environment[7]. The integration of state-of-the-art technologies[8] has become a critical component in enhancing operational safety. For instance, advancements in automation and digitalization[9][10][11], exemplified by systems for real-time risk monitoring, facilitate continuous risk assessment and management, which is vital for adapting to the evolving maritime landscape[12][13].

Furthermore, the application of predictive analytics and machine learning techniques has exhibited promise in the identification of preliminary indications of maritime safety hazards. Such resources permit stakeholders to undertake preemptive measures with a view to reducing risks before negative incidents occur,

thereby enhancing overall safety[14]. The maritime industry's reliance on technology extends to the domain of cybersecurity. The increasing digitization of vessels introduces new vulnerabilities that must be addressed to prevent cyber incidents that could compromise safety[15][16].

Furthermore, the transition towards alternative fuels and eco-friendly technologies gives rise to novel challenges and hazards that necessitate comprehensive assessment and supervision. For example, the transition to hydrogen and ammonia as energy sources gives rise to unique safety concerns that differ significantly from those associated with conventional fossil fuels. This necessitates a re-evaluation of the existing risk management structures[17][18].

It is of paramount importance to mitigate operational risks in maritime transport in order to ensure the safety of personnel, the preservation of the marine environment, and the reliability of maritime operations. The ongoing advancement of technologies and the emergence of new operational models underscore the necessity for a forward-thinking and flexible risk management strategy in the maritime sector.

As the maritime sector continues to encounter operational challenges, innovative technologies are emerging as potential solutions to enhance safety, efficiency, and sustainability[6][8]. Blockchain technology has garnered significant attention due to its potential to revolutionize numerous aspects of maritime operations. The following section will examine how blockchain solutions can address some of the most pressing operational challenges within the maritime transport industry, offering new avenues for enhanced transparency, security, and risk management.

3. Blockchain solutions for addressing operational challenges in the maritime transport sector

The maritime shipping industry is confronted with a multitude of operational risks, including deficiencies in documentation, inadequate transparency, and susceptibility to fraud. The advent of blockchain technology presents a number of innovative solutions for mitigating these risks. This discussion will examine the various strategies for the implementation of blockchain technology in the context of maritime transportation, delineating the manner in which each strategy addresses specific operational challenges.

Enhancing documentation processes

A significant operational risk in maritime transport arises from the reliance on conventional documentation practices, which are often cumbersome and prone to inaccuracies. Blockchain technology has the potential to streamline documentation procedures by providing a decentralized and immutable ledger for all transactions. This ensures that all stakeholders have access to identical information in real time, thereby reducing the probability of discrepancies and fraud. As an illustration, the deployment of blockchain technology for electronic bills of lading can markedly enhance the efficacy of cargo management and reduce the time spent on administrative tasks, as evidenced by the findings of Jović et al. [19]. The transparency afforded by blockchain facilitates enhanced monitoring of documents, thereby reducing the probability of documents being misplaced or modified.

Furthermore, the incorporation of smart contracts into blockchain frameworks can facilitate the automation of numerous documentation-related processes. Smart contracts perform specific actions automatically when predetermined conditions are satisfied, thereby reducing the necessity for human involvement and the potential for errors. This automation not only accelerates processes but also improves adherence to regulations, as observed by Harshvardhan and Teoh[20]. Blockchain technology can mitigate operational risks associated with documentation errors by ensuring the accuracy and accessibility of all relevant documentation.

Improving transparency and traceability

Transparency is of paramount importance in the reduction of operational risks within the domain of maritime transport. Blockchain technology inherently provides a transparent framework wherein all transactions are documented and accessible to authorized individuals. This degree of transparency facilitates the monitoring of goods throughout the supply chain, thereby reducing the probability of theft and fraud. As observed by Elmay et al., the complex and intricate nature of maritime operations frequently results in a lack of trust among stakeholders[21]. This can be mitigated by blockchain's traceability capabilities[21].

The use of blockchain technology allows participants to confirm the legitimacy of shipments and monitor their journey from the point of origin to the destination. This feature is particularly beneficial in addressing issues such as cargo theft and the distribution of counterfeit products. The research conducted by Kapidani et al. indicates that the capacity to track products in real-time can facilitate the establishment of trust among all parties involved in the shipping process, which consequently reduces operational risks associated with ambiguity and false information[22].

Facilitating collaboration among stakeholders

The maritime transport sector encompasses a multitude of stakeholders, including shipping firms, port authorities, customs agencies, and logistics providers. The aforementioned complexity frequently results in communication and coordination that is fragmented and uncoordinated, which in turn heightens the operational risks inherent to the sector. Blockchain technology has the potential to enhance collaboration by offering a shared platform for all stakeholders to access and modify information in real time. Gausdal et al. endorse this collaborative approach, noting that shipping companies can derive benefits through a coopetition framework, whereby they collaborate to develop blockchain applications that enhance operational efficiency[23].

Furthermore, the integration of blockchain technology can facilitate enhanced communication and data exchange among stakeholders, thereby reducing the probability of miscommunication and delays. As underscored by Pu and Lam, the implementation of blockchain technology can streamline processes and facilitate the differentiation of services, thereby enabling companies to address operational challenges in a more efficacious manner[24].

Enhancing security measures

Furthermore, operational risks in maritime transport also arise from security weaknesses, particularly in regard to cyber threats. Blockchain technology offers enhanced security capabilities due to its decentralized structure and cryptographic methods. The safeguarding of data on a blockchain allows organizations to protect sensitive information from unauthorized access and manipulation. The research conducted by Petković et al. illustrates the potential of blockchain technology to enhance the security of autonomous vessels, which are becoming increasingly integral to maritime operations[25].

Furthermore, blockchain technology can facilitate the creation of secure identities for ships and cargo, thereby reducing the probability of identity fraud. This is of particular importance in an industry where the authentication of documents and cargo is of paramount importance. Moreover, the integration of blockchain technology with Internet of Things (IoT) devices can enhance security through the provision of real-time monitoring of cargo conditions and locations, as discussed by Zhou et al.[26]. The incorporation of these technologies can significantly diminish the operational risks associated with security breaches.

Addressing regulatory compliance

Compliance with regulations represents a significant challenge within the maritime sector, with a multitude of international and domestic laws governing the conduct of shipping operations. Failure to comply with the relevant regulations can result in significant financial penalties and operational disruptions. Blockchain technology can facilitate compliance by providing a transparent and immutable record of all transactions and actions. This feature allows companies to demonstrate with greater ease their compliance with regulations, as all relevant information is readily accessible for audit purposes.

The study conducted by Feng and Shao underscores the potential of blockchain technology to facilitate compliance with environmental regulations by providing a reliable system for recording emissions and monitoring environmental impacts[27]. The use of smart contracts to automate compliance reporting allows organizations to mitigate the risk of non-compliance and the associated penalties. This forward-thinking strategy for adhering to regulations has the potential to enhance operational stability and mitigate risks in maritime transportation.

Streamlining supply chain management

The maritime transportation industry is of great consequence to global supply chains, and inefficiencies in this field can result in considerable operational risks. Blockchain technology has the potential to enhance supply chain management by creating a unified source of truth for all transactions. This degree of transparency enables more effective inventory control, demand forecasting, and logistics planning, which in turn reduces the risks associated with stockouts and overstocking.

As posited by Tan and Sundarakani, the integration of blockchain technology into supply chain processes can enhance transparency and collaboration among diverse stakeholders[28]. Enhanced collaboration has the potential to result in more streamlined operations and shorter lead times, thereby minimizing the risks associated with supply chain interruptions. The deployment of blockchain technology enables businesses to enhance the efficiency of their supply chains and reinforce their operational resilience.

Utilizing data analytics for risk management

The implementation of blockchain technology in the maritime transport sector also presents opportunities for the advancement of data analytics. By aggregating and analyzing data from blockchain transactions, businesses can gain valuable insights into their operations and identify potential risks. This approach, which is data-driven, facilitates proactive risk management, thereby enabling companies to address issues in a timely manner before they become significant problems.

The study by Wong et al. underscores the importance of integrating machine learning with blockchain technology to enhance supply chain management[29]. The application of data analytics enables organizations to identify patterns and trends that may indicate potential operational risks, facilitating prompt intervention. This capacity not only enhances risk management but also facilitates the continuous improvement of operational procedures.

Fostering innovation and continuous improvement

The implementation of blockchain technology can foster an environment conducive to innovation and continuous improvement within the maritime transportation industry. The adoption of new technologies enables businesses to enhance operational efficiency and maintain competitiveness in an evolving market. The collaborative nature of blockchain technology encourages stakeholders to work together to develop innovative solutions to shared challenges.

As noted by Ahn et al., fostering innovation within the maritime sector is of paramount importance for improving safety and operational efficacy[30]. The application of blockchain technology enables businesses to investigate innovative business models and operational strategies that enhance their resilience to operational risks. A focus on innovation has the potential to result in a maritime transport sector that is more agile and adaptable.

In light of the multifaceted challenges and potential solutions to the management of operational risks in maritime contexts, with a particular focus on the beneficial implications of blockchain technology, it is essential to consolidate these insights and consider their broader implications. The following section will provide a concise summary of the article's key points, examine the potential implications of these developments for the maritime sector, and suggest avenues for future research and the application of strategies aimed at mitigating operational risks.

4. Conclusion

An examination of the potential of blockchain technology in the management of operational risks within the maritime industry reveals a number of innovative strategies that have the potential to significantly enhance safety, efficiency, and transparency. The implementation of blockchain solutions addresses signifi-

cant challenges, including inefficiencies in documentation, insufficient transparency, security vulnerabilities, and issues pertaining to regulatory compliance.

Key findings from the analysis include:

1. Blockchain technology has the potential to optimize documentation workflows, minimizing errors and fraudulent activities through the use of decentralized, immutable ledgers.

2. Enhanced transparency and traceability enhance stakeholder confidence and mitigate the risks associated with cargo theft and counterfeiting.

3. The technology facilitates collaboration between industry participants, thereby reducing the potential for misunderstandings and delays in operations.

4. The decentralized nature of blockchain technology allows for the implementation of enhanced security protocols, particularly in the domains of cybersecurity and identity verification.

5. The implementation of clear record-keeping and automated reporting through the use of smart contracts facilitates compliance with regulations.

6. The management of the supply chain has been optimized, resulting in more effective inventory monitoring and a reduction in the likelihood of disruption.

7. The capacity to analyse data has been enhanced, thereby facilitating proactive risk management and ongoing improvements in operational procedures.

The findings suggest that blockchain technology has the potential to revolutionize the manner in which operational risk is managed within the maritime transport sector. Nevertheless, the successful implementation of this approach will require the collaboration of stakeholders across the industry, the support of regulatory authorities, and the continued development of technological solutions.

Future research directions could include:

1. Examining the ability of blockchain solutions to scale for extensive maritime operations.

2. Investigating how blockchain can be combined with other innovative technologies like AI and IoT to achieve effective risk management.

3. Evaluating the lasting economic and ecological effects of implementing blockchain in the maritime industry.

4. Analyzing the human elements involved in the adoption of blockchain, focusing on necessary training and opposition to change.

5. Creating uniform protocols for the application of blockchain in maritime operations to guarantee compatibility among various systems and participants.

6. Analyzing the legal and regulatory structures necessary for the broad adoption of blockchain within the industry.

In conclusion, while blockchain technology offers promising avenues for mitigating operational risks in the maritime domain, its full potential remains untapped. It is imperative that ongoing research, development, and collaboration among industry stakeholders be pursued in order to fully leverage the advantages of this revolutionary technology and establish a safer, more effective, and robust maritime transportation industry.

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VEHICLE CLASSIFICATION AS A TOOL FOR PROMOTING SUSTAINABLE URBAN MOBILITY AND DEVELOPMENT

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Abstract

The classification of vehicles is of vital importance in the advancement of sustainable urban mobility and development. This research examines the impact of vehicle classification on urban sustainability, considering the environmental, economic, social, and public health implications. By directing targeted policies and enhancing the efficiency of infrastructure, vehicle classification contributes to reductions in emissions and the promotion of social equity, resulting in more efficient and sustainable transportation systems. The integration of vehicle classification into transport policies enables the formulation of regulations that endorse the adoption of cleaner technologies and prioritize the utilization of low-emission vehicles. Additionally, it facilitates the development of infrastructure by accommodating a variety of transportation modes. Moreover, the categorization of vehicles according to their emissions profiles serves to enhance environmental sustainability, encourage the adoption of low-emission alternatives, and address the needs of disadvantaged groups. As urban areas continue to expand, it will be imperative to implement effective vehicle classification within urban planning in order to establish fair and sustainable environments for future generations.

Keywords: Vehicle classification, Sustainable urban mobility, Sustainable development, Social equity

1. Introduction

The categorization of land transport vehicles has been a topic of interest for policymakers, urban planners, and environmental advocates for many years. It is crucial to comprehend the impact of vehicle classification on urban mobility in order to develop sustainable and equitable transportation systems.

Prior research has examined the potential benefits of categorizing vehicles by type, including enhanced infrastructure efficiency and reduced emissions. However, there is a need for more research examining the specific impacts of vehicle classification on urban mobility, particularly in the context of sustainable development. This paper aims to extend the knowledge by examining the potential of vehicle classification to facilitate sustainable urban development.

The research question of the paper is as follows: In what ways does vehicle classification influence urban mobility, and what are the consequences for sustainable development? The objective of this paper is to provide a comprehensive examination of the impact of vehicle classification on urban mobility and sustainable development.

The findings of this study indicate that the classification of vehicles has the potential to facilitate sustainable urban growth by enabling the implementation of targeted policies, enhancing the efficiency of infrastructure, reducing emissions, and promoting social equity.

2. The Multifaceted Impact of Land Transport Vehicle Classification on Sustainable Urban Development

The categorization of land transport vehicles is of vital importance with regard to the formulation of transport policy, the development of infrastructure, and the promotion of environmental sustainability. The classification of vehicles is not only instrumental in the formulation of targeted policies but also enhances the efficiency of infrastructure utilization and mitigates the environmental consequences associated with transportation. This comprehensive strategy is of paramount importance for addressing the complex challenges posed by urban growth, climate change, and the pursuit of sustainable development[1].

The integration of vehicle classification into transport policy is a crucial step in the development of effective regulatory frameworks that advance sustainable transportation. For instance, policies that differentiate between various vehicle categories—such as traditional, hybrid, and electric cars—enable governments to tailor incentives and regulations that encourage the adoption of cleaner technologies. This is particularly crucial in urban settings, where the concentration of vehicles has a pronounced effect on air pollution and greenhouse gas emissions. A review of the literature reveals that cities such as Seoul have implemented policies that regulate vehicle operations based on emission classifications. These policies have been shown to reduce air pollutants and encourage the use of environmentally friendly transportation alternatives[2]. It is imperative that policies be tailored to achieve sustainability objectives, as this enables the prioritization of low-emission vehicles within urban transport networks.

The categorization of land transport vehicles is an invaluable tool for those engaged in infrastructure planning. By gaining an understanding of the characteristics and requirements of different vehicle categories, planners can develop road systems, parking areas, and public transport networks that facilitate the use of multiple transport modes. For example, the incorporation of park-and-ride services can facilitate a transition from private vehicle usage to public transportation, thereby reducing congestion and lowering emissions[3][4]. Moreover, the classification of vehicles facilitates the assessment of infrastructure necessities, ensuring that financial resources are allocated to advance sustainable transportation. The creation of comprehensive transport models that incorporate the diverse range of vehicles in

use can enhance the efficacy of urban transportation systems, as evidenced by research examining spatial location preferences and accessibility[5].

The concept of environmental sustainability serves to underscore the vital importance of categorizing land transport vehicles. The transportation sector is a significant contributor to global greenhouse gas emissions, making the adoption of sustainable transport practices a vital strategy for addressing climate change[6][7]. By categorizing vehicles according to their emissions profiles, policymakers can develop strategies that encourage the utilization of low-emission and zero-emission vehicles. For instance, the promotion of electric vehicles has been identified as a pivotal strategy for mitigating urban air pollution and achieving sustainability objectives [8][9]. Furthermore, the classification of vehicles allows for the evaluation of their life-cycle emissions, which is crucial for comprehending their overall environmental impact [10][11]. This comprehensive assessment can inform the development of policies that encourage the adoption of environmentally sustainable vehicles and mitigate the reliance on transportation systems reliant on fossil fuels.

In addition to the environmental benefits, the classification of land transport vehicles can facilitate social equity in urban transportation systems. In order to achieve sustainable transportation strategies, it is essential to address the specific requirements of at-risk groups, including low-income individuals, the elderly, and those with disabilities. By classifying vehicles and recognizing their accessibility characteristics, policymakers can create inclusive transportation solutions that guarantee fair access to mobility choices [12][5]. This is of particular importance in urban areas where unequal access to transportation can serve to exacerbate existing social inequalities. In order to foster a more equitable urban environment, it is essential to integrate a variety of transportation options, including walking, cycling, and public transit[13].

Moreover, the classification of land transport vehicles is crucial for fostering innovation within the transportation industry. In light of the emergence of novel technologies such as autonomous vehicles and sophisticated driver-assistance systems, it is evident that revised classifications are necessary. Such developments have the potential to transform urban mobility and reduce the environmental impact of transportation systems. Nevertheless, it is imperative that robust policy frameworks be developed to oversee the incorporation of these technologies into existing transportation networks [14]. The classification of vehicles according to their technological characteristics enables policymakers to obtain a more precise comprehension of the impact of these innovations on transportation policy and infrastructure development.

The financial implications of vehicle categorization are of considerable consequence. The transportation industry plays a significant role in economic activity[15], and the effective classification of vehicles can result in savings for both governments and consumers. To illustrate, the promotion of fuel-efficient vehicles can lead to a reduction in overall fuel consumption and a subsequent decrease in transportation costs for both individuals and businesses[16]. Furthermore, the classification of vehicles can inform investment decisions regarding infrastructure, ensuring the optimal allocation of resources to advance sustainable transportation initiatives[17]. This perspective on economic theory is of paramount importance for garnering support for sustainable transportation initiatives, as stakeholders are more likely to engage in projects that demonstrate tangible financial benefits.

Furthermore, the classification of land transport vehicles has the potential to enhance public health outcomes by reducing the detrimental impacts associated with transportation. Vehicle emissions represent a significant contributor to respiratory illnesses and a range of other health concerns, particularly in urban settings. By encouraging the use of cleaner vehicle technologies and enforcing regulations that restrict high-emission vehicles, authorities can facilitate improvements in air quality and overall public health [18][19]. The integration of health considerations into transportation policy is gaining recognition as a pivotal step towards the attainment of broader sustainability goals. This is evidenced by research examining the health impacts of transport systems[14].

The impact of categorizing land transport vehicles on sustainable urban growth is not limited to environmental and financial considerations. Furthermore, it encompasses social equity, public health, and technological advancements, thereby establishing an all-encompassing strategy for urban mobility.

3. Conclusion

The comprehensive analysis of the impact of land transport vehicle classification on sustainable urban development demonstrates its pivotal role in shaping the future of cities. This research has demonstrated that vehicle classification is not merely a means of categorization, rather, it is a crucial instrument for addressing complex urban issues. By influencing policy decisions, guiding infrastructure development, and supporting environmental initiatives, vehicle classification plays a pivotal role in constructing transport systems that are more efficient, equitable, and sustainable.

The multifaceted consequences of this phenomenon, which encompass environmental, economic, social, and public health dimensions, underscore the imperative for a unified approach to urban mobility. As urban areas continue to expand and evolve, it is becoming increasingly evident that enhancing vehicle classification systems and integrating them into comprehensive urban development plans is of paramount importance. This strategy responds to present urban issues while simultaneously establishing the foundation for future advancements in mobility and urban planning.

In the future, the continued development of vehicle classification techniques, in conjunction with technological advancements[20] and evolving societal demands, will be pivotal in fostering more liveable, resilient, and sustainable urban environments. By adopting this comprehensive approach, cities can more effectively address the complexities of contemporary urban development, ensuring that transportation systems not only fulfill current needs but also adjust to future challenges. Ultimately, the deliberate incorporation of ve-

hicle classification into urban planning and policymaking will prove to be a pivotal element in the development of sustainable cities for future generations.

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IMPACT OF CLOUDIFICATION OF CORPORATE SYSTEMS ON BUSINESS MODELS AND DEVELOPMENT STRATEGIES OF COMPANIES

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Abstract
The article examines the impact of cloudification of corporate systems on business models and strategies of companies in a rapidly changing technological landscape. Cloudification, understood as the transition to cloud platforms, enables significant cost reduction, increased flexibility, and accelerated innovation. The focus is on analyzing successful cases of cloud technology implementation and their impact on value creation for customers and competitive advantages. The study emphasizes the importance of a strategic approach to cloud technologies for achieving sustainable growth and efficiency in modern business conditions.

Keywords: cloudification, business models, strategies, cloud technologies, innovations.

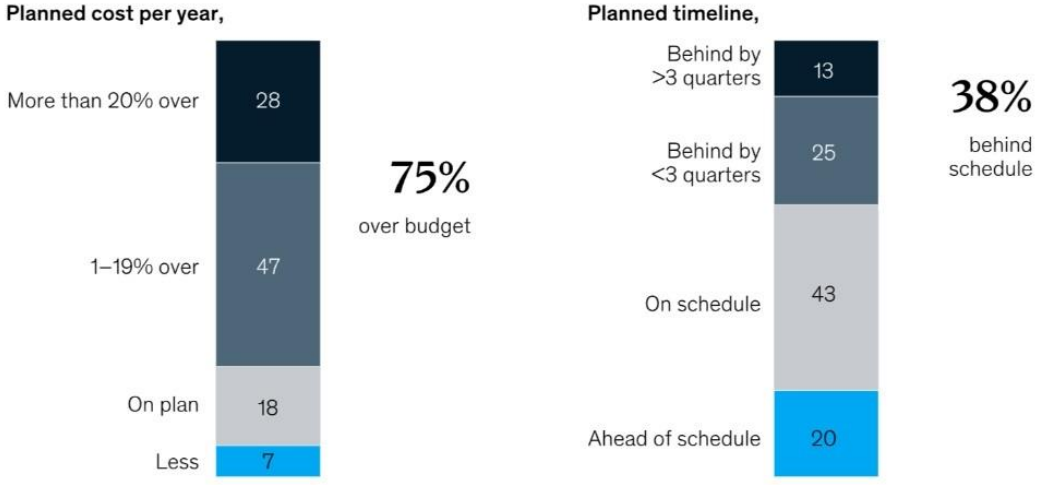
Introduction

Modern companies face the necessity of constant adaptation to changes in a technological environment that is becoming increasingly dynamic. Cloudification is the process of transitioning corporate systems, applications, data, and IT infrastructure to cloud platforms. This transition to cloud platforms for managing data, resources, and processes provides businesses with a wide range of opportunities: from cost reduction to increased flexibility and speed of innovation implementation. This technological phenomenon not only changes the internal processes of companies but also has a significant impact on their business models and development strategies.

The aim of this study is to investigate the impact of cloudification on the development of business models and strategies of companies across various industries. Particular attention is given to the analysis of successful cloud use cases, as well as the comparison of theoretical models with real business examples.

Main part. Cloudification as a technological driver and its impact on business models

Cloud technologies (CT) are transforming traditional approaches to data management, production processes, and customer interaction. The main process of cloudification is the **migration of infrastructure**, applications, and data to the cloud, allowing companies to save on capital expenditures while focusing on operational costs. According to a report by **McKinsey** [1], companies that actively implement **CT** can achieve savings of up to **47 % on IT infrastructure costs**, as well as enhance the **efficiency of resource utilization.** Although companies are moving more workloads to the cloud, errors in migration coordination led to negative consequences. Data shows that due to this inefficiency, companies, on average, spend 14 % more on migration than planned, and 38 % of companies have delayed migration by more than a quarter (pic. 1).



Pic. 1. Budget for cloud migration vs actual spend on cloud migration, %

Also, a report by **The Hackett Group** [2] indicates that **migrating to the cloud** allows companies to reduce **labor costs by 18-20 %** and lower overall IT expenses by an average of **20-30 % in the first few years** after the transition. The **flexibility of CT** enables companies to respond more quickly to **market changes** and implement new **business solutions**.

The implementation of **CT** impacts corporate systems and business as a whole. **For example, distributed systems provide data processing and resource management across physical nodes that may be located in different geographical locations.** This contributes to increased **reliability**, **fault tolerance**, and **flexibility** of systems, which is critically important for companies operating on a global scale.

In the context of cloudification, **Big Data** becomes an important tool for companies striving for **analytical transformation** of their business processes. **It** refers to vast datasets characterized by high generation speed, diverse sources, and significant volumes [3]. Cloud platforms, such as **Google Cloud** or **Microsoft Azure**, provide companies with the ability to store, process, and analyze large datasets using **distributed systems**. These capabilities enable businesses to derive valuable insights in real-time, enhancing their ability to make informed, data-driven decisions. Furthermore, the scalability of cloud platforms ensures that as data volumes grow, companies can efficiently manage and analyze this data without compromising performance or speed.

Distributed systems and Big Data analytics supported by CT shape companies' development strategies, driving them towards more data-driven decision-making processes. This means that decision-making increasingly relies on in-depth data analysis rather than intuitive or subjective assumptions. Visual changes in business strategy based on the experiences of companies can be seen in **table 1**.

Table 1

Changes in companies' strategy policies with and without cloudification [4]

Aspect	Without cloudification	With cloud technologies (cloudification)
Cost structure	High capital expenditures on it infrastructure.	Cost reduction of 20-50 % due to cloud services.
Flexibility	Limited scalability of resources.	High flexibility: ability to scale resources in real-time based on needs.
Deployment speed	Long process for implementing new systems and applications.	Fast deployment of new applications and services, accelerating time-to-market.
Innovation	Reliance on outdated technologies.	Active adoption of innovations and technologies like Big Data and IoT.
Data analysis	Limited data analysis capabilities.	Expanded real-time data analysis capabilities and use of analytics for decision-making.
Project management	Complicated project management dependent on physical infrastructure.	Improved project management using cloud tools and collaboration platforms.
Security	Data vulnerability due to local storage.	Enhanced security and data protection through cloud solutions and automatic updates.

It can be said that **cloudification is not just a technological process**, but a strategic tool that changes companies' approaches to management. Depending on the level of control and management, there are three models of cloud services. **Infrastructure as a Service (IaaS)** provides companies with flexible resources to scale their operations without the need for significant capital investments. Companies can dynamically adjust their capacities based on business needs, reducing risks associated with investments in physical infrastructure [5]. **Software as a Service (SaaS)** provides access to applications over the Internet, eliminating the need for local installation and maintenance. **SaaS** allows companies to cut licensing and support costs while accelerating the deployment of new applications [6]. **Platform-as-a-Service (PaaS)** enables the development and deployment of applications, providing developers with tools for cloud-based work, which also improves flexibility and speeds up the development of new solutions [7].

Cloudification has a significant impact on traditional business models, compelling companies to rethink their approaches to creating and delivering value. A change in the **cost structure** is one of the most evident consequences of cloudification. Companies are transitioning from **capital expenditures (CapEx)** to **operational expenses (OpEx),** allowing for better cash flow management and reducing financial risks [8].

Another important step in cloudification is creating a value model for customers. Thanks to cloud technologies, companies can offer customers more flexible and scalable solutions, such as subscription or **on-demand models**. This allows for more **customized services**, increasing customer satisfaction and creating new revenue streams. For instance, companies like **Spotify** utilize cloud platforms to deliver content on a subscription basis, enabling them to scale their offerings quickly and attract new customers. Additionally, cloud-based models allow businesses to gather real-time user data and feedback, which can be used to continuously refine and personalize services. This approach not only strengthens customer loyalty but also helps companies stay competitive by rapidly adapting to market demands.

Cloudification also fosters the emergence of new business models based on **resource sharing.** It allows companies to efficiently manage their operations without the need to own significant assets, opening up new opportunities for growth and scalability.

Transformation of growth and development strategies for companies

The implementation of **CT** necessitates significant changes in companies' development strategies. One of the key aspects is the **differentiation strategy**. Through cloudification, companies can **rapidly implement innovations** and offer customers new products

and services, helping them stand out in the market. For example, **Amazon Web Services (AWS)** provides platforms and tools for the quick development and deployment of new solutions, allowing to **reduce time-to-market**.

The **risk management strategy** is also undergoing transformation. CT mitigate risks associated with IT infrastructure management by automating processes, backing up data, and ensuring security. This allows companies to focus on their core business without diverting resources to maintain internal IT systems. Instead of large one-time investments in technology, companies can distribute their expenses over time, reducing financial burden and making the business more resilient to changes.

Cloudification also facilitates changes in **growth and scaling strategies**. The use of CT enables companies to quickly enter new markets and expand their operations without significant investments in infrastructure. This is especially relevant for **startups** and **small businesses**, which can compete with larger players by rapidly adopting cloud solutions. For instance, companies using cloud platforms for **e-commerce** (the process of buying and selling goods and services online) can quickly scale their operations, responding to changes in demand and expanding their presence in various regions.

For utility companies, transforming operations and systems through digital technologies can provide significant benefits, such as reducing operational costs by up to 25 %. Additionally, productivity may increase by 20-40 % in areas such as safety, reliability, customer satisfaction, and regulatory compliance [4].

The comparison between companies that have implemented **cloudification** and those that continue to use traditional systems reveals clear advantages of CT in today's market. Companies utilizing **cloud solutions** demonstrate higher growth rates and greater flexibility in adapting to changes in market conditions. This is particularly important in the context of **global competition** and rapidly evolving technologies.

Companies that remain on traditional IT systems face several challenges, including **high infrastructure maintenance costs,** limited scalability options, and decreased competitiveness. While companies that have adopted CT can quickly respond to changes in the business environment, those adhering to traditional systems often spend more time and resources modernizing their IT solutions.

Conclusion

Cloudification of corporate systems has a profound impact on business models and development strategies, reshaping cost structures and enhancing operational flexibility. By shifting expenses from CapEx to OpEx, companies can reduce investment risks and better manage cash flow, leading to significant savings in IT infrastructure and operational costs. This transition also allows businesses to dynamically adjust their resources and infrastructure based on real-time needs, improving scalability and competitive positioning in the market.

Additionally, CT foster a culture of innovation by enabling the rapid development and deployment of new products and services. Businesses utilizing cloud platforms benefit from advanced data analytics and artificial intelligence capabilities, which support data-driven strategies and more informed decision-making processes. These capabilities not only streamline operations but also help companies respond swiftly to market demands, thus enhancing growth opportunities and long-term sustainability in a rapidly evolving technological environment.

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