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Section 1. Biology

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ASSESSMENT OF RELATIONSHIP IN CHICKPEA (CICER ARIENTINUM L.) BASED ON PRODUCTIVITY CHARACTERISTICS AND SSR MARKERS IN AZERBAIJAN

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Abstract

Genetic diversity and marker–trait associations related to yield components were assessed in 43 chickpea (*Cicer arietinum* L.) accessions from a germplasm collection using winter-sown seeds in Azerbaijan. The accessions originated from Azerbaijan, Iran, and the International Center for Agricultural Research in the Dry Areas (ICARDA). Molecular genotyping was conducted using ten simple sequence repeat (SSR) markers. Yield and its components were evaluated across eight traits in field experiments. Correlation analysis revealed that yield was primarily influenced by plant height, the number of branches, and the formation of a high number of pods. These traits showed their highest values in chickpea genotypes. SSR analysis detected between four and seven alleles per marker. The highest levels of polymorphism were observed in markers TA46 (PIC = 0.88), H1A12 (PIC = 0.84), and H3E04 (PIC = 0.82), while the lowest were recorded in NCPGR6 (PIC = = 0.42) and H4E04 (PIC = 0.44). Cluster analysis grouped the accessions into five distinct clusters. Several unique alleles identified through this analysis may serve as molecular identifiers (passport markers) for specific genotypes. These informative markers can be useful for chickpea breeding programs focused on yield improvement. Breeding lines with sufficient genetic distance from this study can be used as appropriate parents to get more heterotic recombinants. Correlation analysis was performed between 10 SSR primers and yield components, informative SSR primers related to important trait of plant height were found.

Keywords: *SSR, molecular markers, yield-related components, cluster, correlation*

Introduction

Chickpea (*Cicer arietinum* L.) is an annual, self-pollinated diploid legume plant species from the Fabaceae family, providing high-quality plant protein to more than 30% of the world's population. In 2018, 17.2 million tons of chickpeas were produced from 17.8 million hectares of land worldwide (JHA, *et al*., 2021). As in other parts of the world, chickpea production in Azerbaijan is increasing year by year, and in 2022, it covered more than 6,189 thousand hectares. Particularly in the southern regions of Azerbaijan, chickpeas are successfully cultivated under non-irrigated conditions on an area of 4,642 thousand hectares (https://www.stat.gov.az/source/agriculture). The ability of chickpea plants to withstand drought and moisture deficiency is key to their successful cultivation under non-irrigated conditions in Azerbaijan (Mazkirat, *et al*. ., 2023, R_core_team, 2023). Additionally, chickpea plants can tolerant cold stress from low temperatures and even short periods of freezing. Therefore, winter chickpeas are also used in central regions, where winters are mildly cold and the plants can grow and overwinter under these conditions.

The genetic diversity in germplasm collections of crops, including chickpea, can be an essential resource for identifying and utilizing genotypes adapted to specific regional growing conditions, leading to their successful application in breeding programs (Serekpayev, *et al*., 2016; SARI, *et al*., 2023). The use of molecular markers in genetic diversity studies can further enhance the effective utilization of germplasm collections (Fayaz, et al. 2021).

The discovery of molecular markers closely linked to key breeding traits has enabled the implementation of marker-assisted selection (MAS) (Bradbury, *et al*., 2007). In the breeding of chickpea and other legume crops, microsatellite markers (SSRs) have been successfully used for assessing genetic diversity and facilitating selection processes, including MAS (Bradbury, *et al*., 2007; Liu, *et al*. 2005; Serrote, *et al*. 2020; Varshney, *et al.,* 2014). SSR markers exhibit codominant inheritance, which is particularly important for analyzing hybrid populations (Liu et al. 2005). The high polymorphism of SSR loci and their widespread distribution across the genome provide valuable information on genetic variation among studied germplasm collections (Bhattarai, *et al*., 2021; Serekpayev, *et al*., 2016).

The objectives of this study were: (1) to assess the genetic diversity in a chickpea germplasm collection from Azerbaijan using SSR markers, and (2) to analyze associations between SSR allelic variants and yield components in chickpea genotypes to improve productivity under winter and spring sowing conditions.

Materials and methods

In this study, 43 chickpea (*Cicer arietinum* L.) accessions were used from the legume germplasm collection maintained by the National Gene Bank of the Genetic Resources Institute of ARSEM. The chickpea accessions originated from Azerbaijan, Iran, and the International Center for Agricultural Research in the Dry Areas (ICARDA) (Table 1). Local improved varieties – Narmin and Jamila were obtained by selecting from ICARDA introductions in different years. Genotypes were planted in 2023–2025 and evaluated according to international descriptors. The planting scheme of the samples was as follows: in chickpea the length of the spots was 5 meters, width 2.0 meters, row spasing 30 cm, and inter seed spasing 5cm. Each chickpea genotype was planted in two replicates using a completely randomized block design. A total of 100 seeds were sown per genotype, and the local standard variety Jamila was used as a control for comparison. The following traits were measured: plant height, number of branchs, number of productive branches, the height to first pod, number of pods per plant, seed yield per plant, 100 seed weight, seed yield per $1m^2$.

Molecular Analysis

For each genotype, genomic DNA was extracted from fresh leaves using CTAB protocol by DOYLE and DOYLE (1987). The quality and quantity of extracted DNA was determined by measuring absorbance at 260 and 280 nm using spectrophotometer. The DNA concentration was diluted to 100 ng/μL using ddH2O. PCR was carried out in a total volume of 15 μL containing 1.5 μL of 10 × PCR buffer, 2 mM $MgCl_2$, 0.15 μM of each dNTP, 0.7 μM of each primer, 0.5 U of Taq

DNA polymerase. The reactions were carried out in a Bio-Rad iCycler system (Bio-Rad Laboratories, Hercules, CA, USA) with the following program: an initial step of 94 °C for 3 min; 30 cycles of 94 °C for 1 min; 55 °C for 1 min and 72 °C for 1 min; and a final step of 72 °C for 5 min (Varshney, 2005).

PCR products were visualized on 8% polyacrylamide gel at a constant rate of 200 V for 70 min and detected via staining with ethidium bromide. Electrophoresis images were obtained using BIO-RAD gel documentation system.

Table 1. *Origin and morphological characteristics of studied chickpea germplasm collection*

No.	Genotypes	Origin	No.	Genotypes	Origin
1	Narmin	Azerb.	23	Jalilabad 11	Azerb.
2	Jamila St.	Azerb.	24	Flip 97–32	ICARDA
3	Ağdenli	Russian	25	Shamakha 25	Azerb.
4	F.13–154 C	ICARDA	26	Yardımlı 29	Azerb.
5	F.13–227 C	ICARDA	27	Agdash18	Azerb.
6	F.13–234 C	ICARDA	28	Sultan	Azerb.
7	F.13–320 C	ICARDA	29	Yardımlı 27	Azerb.
8	F.13–358 C	ICARDA	30	Masallı 30	Azerb.
9	F.13–364 C	ICARDA	31	Masallı 51	Azerb.
10	F. 88–85 C	ICARDA	32	Bilasuvar 58	Azerb.
11	F. 93–93 C	ICARDA	33	Lerik 33	Azerb.
12	F.13–53	ICARDA	34	Absheron 35	Azerb.
13	F.13–55	ICARDA	35	Lankaran 1	Azerb.
14	F.11–08 C	ICARDA	36	Lankaran 2	Azerb.
15	F.11–01 C	ICARDA	37	Flip03–48	ICARDA.
16	Ordubad 39	Azerb.	38	Jalilabad50	Azerb.
17	Ordubad 41	Azerb.	39	İran 48	İran
18	Qusar 43	Azerb.	40	Jalilabag 55	Azerb.
19	Qusar 44	Azerb.	41	Sabirabad59	Azerb.
20	Agstafa 42	Azerb.	42	Ordubad 47	Azerb.
21	F. 03–22	ICARDA	43	Yardımlı 28	Azerb.
22	Bakı 30	Azerb.			

Ten SSR markers, previously used and recommended for the study of chickpea genetic diversity, were employed to assess the genetic variation among the studied chickpea genotypes (Table 2). To score each polymorphic band, the SSR loci patterns were evaluated using binary codes: '1' for the presence of a band and '0' for its absence. A data matrix based on band presence or absence was generated for further analysis. The number of alleles, major allele frequency, genetic diversity, and polymorphism information content (PIC) were calculated using to WEIR (1990). Cluster analysis was performed using the unweighted pair group method with arithmetic mean (UPGMA), and dendrograms were conducted on the genetic similarity index using NTSYS-pc 2.1 (Rohlf, 2004).

Results and discussion

Chickpea samples were studied and evaluated in a comparative manner alongside the regionalized new standard variety, Jamila. The vegetation period of the plants ranged from 230 to 240 days. The flowering phase occurred between April 15 and April 30, and

the pod formation phase was recorded from May 5 to May 18. Plant height ranged from 55 to 89 cm, with the number of branches varying between 2 and 5. The height of the first bean ranged from 19 to 45 cm, and the number of pods per plant varied from 24 to 65. The weight of 100 seeds ranged from 20.6 to 48.5 g, and the weight of a single seed ranged from 2.0 to 6.0 g. The yield per square meter ranged from 205.5 to 521.7 g. Among the studied chickpea accessions, the following samples outperformed the standard variety in 2–3 key productivity parameters: F.13–320 C, F.13–227 C, F.13–358 C, F.13–364 C, F.88–85 C, F.93–93 C, F.13–53, and Jalilabad 11.

Table 2. *Correlation coefficients among the 8 studied traits in 39 chickpea accessions in the germplasm collection*

Traits	Plant height	Height to first pod (cm)	Number of branches	Number of productive nodes	Number of pods per plant	Seed yield per plant (g)	100 seed weight (g)
Height to first pod (cm)	0.635**						
Number of branches	0.362*	0.075					
Number of productive branches	0.09	0.146	0.115				
Number of pods per plant	0.334*	0.281	0.474**	0.714***			
Seed yield per plant	0.488**	0.691***	0.185	0.690***	0.712***		
100 seed weight	0.404**	0.319*	0.116	0.224	0.423**	0.224	
Yield (g/1m^2)	0.586**	0.218	0.271	0.236	0.257	0.361*	0.252

** 0.01 < p < 0.05; ** 0.001 < p < 0.01; and *** p < 0.001*

Correlation Analysis

The correlation analysis of the yield-related traits in the studied chickpea accessions revealed significant relationships (Table 1). Plant height was positively correlated with first bean height (r = 0.635**), number of productive branches (r = 0.362*), seed mass per plant (r = 0.488**), yield per square meter (r = 0.586**), and the number of pods per plant (r = 0.334*). Seed mass per plant also showed strong correlations with the number of productive branches (r = 0.712***), the number of pods per plant (r = 0.69***), and yield per square meter (r = 0.361*). Additionally, a significant correlation was found between plant height and first bean height (r = 0.635***). The correlation analysis indicated that seed mass, number of pods, and number of fertile branches per plant were positively correlated with yield. These traits were most pronounced in taller, more branched plants. Such chickpea plants are likely to be well-suited for winter cultivation, as they can take advantage of early spring rains while avoiding drought stress during the reproductive stages, which are particularly sensitive to heat and moisture deficits (Lassner, *et al.*, 1989; Serekpayev, *et al.*, 2016).

SSR Markers Analysis

The genetic polymorphism of the studied chickpea germplasm was assessed using 10 SSR primers. Rare alleles were observed at certain loci, with an average polymorphic information content (PIC) value of 0.68 and a Nei genetic diversity index of 0.62. The highest PIC values were recorded for prim-

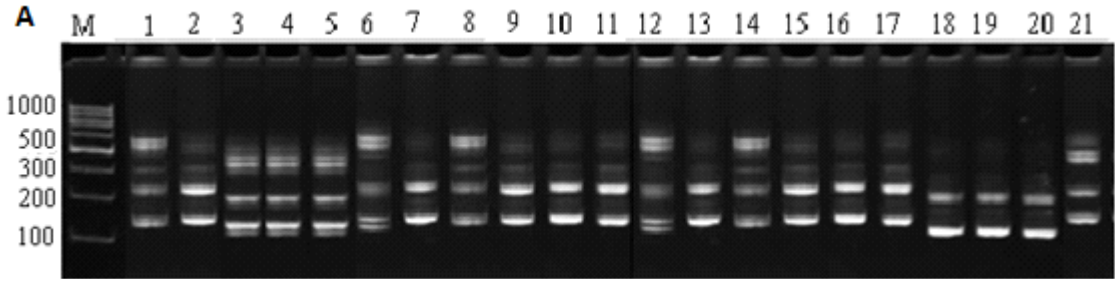
ers TA46 (0.88), H1A12 (0.84), and H3E04 (0.82), while the lowest values were observed for primers NCPGR6 (0.42) and H4E04 (0.44). The results were in accordance to those reported in previous studies (Singh et al., 2023). Seven alleles with high gene diversity and PIC values were identified using the TA46 and H3E04 primers, while only four alleles were recorded with the H4E04 and NCPGR6 primers (Table 2).

Table 3. *Genetic diversity parametrs of SSR primers in the studied chickpea germplasm*

Primer	Motif	Expected allele size, bp	Alleles	PIC	Nei genetic diversity index
TA46	(TAA)22	145–176	7	0.88	0.73
TA142	(TTA)15	128–142	5	0.79	0.70
TA71	(AAT)32	184–232	5	0.72	0.66
TA22	(ATT)40	200–280	6	0.52	0.65
H3E 04	$(TTA)_{36}$ $(CTA)_{5}$	174–216	7	0.82	0.65
H4E 04	$(TTA)_{56}$ $(TTTA)_{3}$	107–114	4	0.44	0.36
H1B09	(TAA)14 (AT)3	181–213	6	0.80	0.73
H1A 12	(TAA)29	129–330	6	0.84	0.77
NCPGR12	(CT)35	213–259	5	0.53	0.44
NCPGR6	(CA)12	230–268	4	0.42	0.47
Mean			5.5	0.68	0.62

A total of 55 amplicons were identified across all SSR primers, with an average of 5.5 amplicons per primer. The size of these alleles ranged from 107 to 330 bp. Among the SSR markers, the Nei genetic diversity index varied from 0.36 (H4E04) to 0.77 (H1A12), with an average genetic diversity of 0.62 cross all primers. This indicates high allelic diversity among the SSR primers selected for the study (Table 2). Based on the overall results, primers TA142, TA46, TA71, H1A12, H1B09, and H3E04 can be considered the most polymorphic microsatellite primers for chickpea genotypes.

Figure 1. *SSR amplification products*



*from (**A**)-TA46; 1-Narmin, 2-Camila, 3-Sultan, Ağdenli, 4-F.13–154 C, 5-F.13–227 C, 6-F.13–234 C, 7-F.13–320 C, 8-F.13–358 C, 9-F.13–364 C, 10-F. 88–85 C, 11-F. 93–93 C, 12-F.13–53, 13-F.13–55, 14-F.11–08 C, 15-F.11–01 C, 16-Ordubad 39, 17-Ordubad 41,18-Qusar 43, 19-Qusar 44, 20-Ağstafa 42, 20-Flip 03–22, 21-Bakı 30*

Cluster Analysis

In the present study, UPGMA was applied to differentiate chickpea accessions based on their genetic distance. The analysis revealed a clear distribution of the studied genotypes into three distinct clusters based on the allelic composition of the analyzed markers (Figure 3).

The first cluster comprised 6 accessions, including genotypes characterized by specific

alleles of 230 and 214 bp for the TA71 and H3E04 primers, respectively. Within this cluster, five accessions were of Azerbaijani origin, one was from Iran, and the remaining accessions were from ICARDA. Notably, ICARDA-introduced Flip 13–55 (№ 13) clustered closely with the local genotype Sultan 98–178 (№ 28), while IRAN 48 (№ 39) was closely related to the local Agdash18 (№ 27). Additionally, the ICARDA-introduced Flip 97–32 (№ 24) and Jamila variety (№ 2) from Azerbaijan were also grouped within the first cluster, indicating a close genetic relationship.

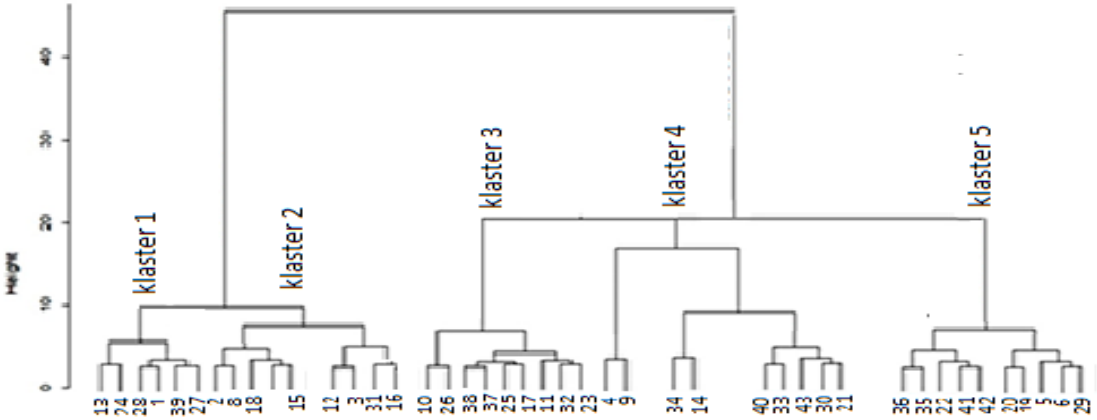
The second cluster consisted of nine chickpea accessions, which carried specific alleles of the TA46 and TA142 markers, with amplicon sizes of 146 and 142 bp, respectively. This cluster included five accessions of Azerbaijani origin (Ordubad 39, Yardimli 27, Masalli 30, Masalli 51, and Jalilabad 11) and two accessions of ICARDA origin (Flip 13–227 and Flip 03–22). Among these, the genetic similarity index between Flip 03–22 and Ordubad 39 was particularly high.

The third cluster included nine chickpea accessions, all of which shared a common allele of 181 bp, detected with the H1B09 primer. Three of the accessions were from ICARDA, while the remaining five were from Azerbaijan.

The fourth cluster also contained nine accessions, which exhibited specific alleles of 193 bp and 213 bp, detected with the H1B09 primer.

The fifth cluster was comprised of ten local accessions (Ordubad 47, Sabirabad 59, Baku 30, Lankaran 1, and Lankaran 2), all of which carried the 114 bp allele of the H4E04 primer. Notably, the Lankaran 1 (№ 35) and Lankaran 2 (№ 36) accessions had a high genetic similarity to each other, yet were located at a relatively greater genetic distance from the other accessions in this cluster.

Figure 2. *Dendrogram derived from UPGMA cluster analysis of 10 SSR marker alleles of 43 chickpea accessions distributed in five clusters*



Marker–Trait Association (MTA) Analysis between SSR Markers and Morphological Traits

As a result of marker–trait association analysis, several significant correlations were found between yield-related traits of first pod height, number of fertile tillers, number of pods per plant, 100-seed mass, seed mass per plant, plant height and NCPGR 12, TA71, TA142, and TA46 SSR primers. (Table 3). Primer TA71 showed positive correlation with three traits and other primers with two traits each were identified as promising markers. Our results are consistent with the results obtained by S. Mazkirat and colleagues (Mazkirat et al., 2023).

Table 4. *Marker–trait associations with MLM models using TASSEL*

Traits	SSR marker	Allels (bp)	pValu
Plant height	TA46	160	0,036*
Height to first pod	TA142	144	0,006
Number of branches	TA142	255	0,017

Traits	SSR marker	Allels (bp)	pValu
Number of productive nodes	TA46	166	0.008
Number of pods per plant	TA142	155	0.014
Seed weight per plant	TA71	246	0.022
	NCPGR12	215	0.010
100 seed weight (g)	TA71	249	0.250
1 m^2 yeald	TA71	233	0.003

*The significance level of the associations is indicated as follows: * 0.01< p <0.05; and ** 0.001 < p < 0.01*

Primer TA142 showed a positive correlation with the number of fertile branches and number of pods per plant, primer TA71 with mass of 100 seeds and mass of seeds per plant and yield, and primer NCPGR 12 with traits of mass of seeds per plant and mass of 100 seeds.

TA46 marker was associated with number of pods per plant and number of branches per plant. Thus, the study of genetic diversity and relationship between SSR primers and yield traits in chickpea plant collection is important for development of breeding strategy under specific agro-ecological conditions.The importance of SSR markers in the study of genetic diversity was also mentioned in previous studies (Singh, *et al*. 2022, Varshney, *et al*., 2014). Using eleven SSR markers, 9 main productivity traits of 39 chikpea samples of different origins were studied, genetic diversity in the chikpea plant was evaluated, and a significant relationship between SSR markers and productivity indicators was emphasized (Liu, et al., 2005). Our study included markers used by previous researchers, and the polymorphism was lower than the results obtained in other studies, which is mainly due to the small number of samples. Specific alleles of TA46, TA71, H1A12, H3E04, H1B09 and TA142 primers were recorded in the chikpea samples we studied. A polymorphic information index (PIC) was calculated to demonstrate the utility of the primers. The UPGMA method, which is the most reliable type of cluster analysis, was used, and the samples were grouped into 5 clusters. The reliability of this method depends on the number of samples and primers. No clear differentiation was observed between the samples according to their origin. This result was also recorded in other studies, which is due to gene flow, exchange of genetic material and mutations occurring during hybridizations (Liu et al., 2005, Serrote et al., 2020).

Conclusion

High allelic diversity was recorded during the SSR marker study of 43 chikpea samples cultivated in Azerbaijan. Moderate genetic diversity (0.62) was observed with all SSR primers. Primers TA142, TA46, TA71, H1B09, H1A12 and H3E04 were recorded as the most polymorphic microsatellite primers for chikpea genotypes. Correlation analysis revealed several significant correlations between yield indicators and NCPGR 12, TA71, TA142, and TA46 SSR primers.

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BUILDING A RECRUITMENT SYSTEM FROM SCRATCH IN A STARTUP: RAPID SCALING STRATEGIES

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Abstract

This article examines the process of creating an effective recruitment system from scratch in the context of high-speed startup growth. It focuses on strategies that make it possible to quickly attract and select talented professionals in conditions of limited resources and tight deadlines. The article analyzes the key stages of recruiting function formation, including identifying personnel needs, selecting optimal recruitment channels, establishing an effective selection process, and introducing technologies for automation and scalability. The importance of evaluating candidates' skills, the significance of a strong employer brand, and the role of corporate culture in attracting top talent are also discussed. The goal of this article is to provide practical guidance for startup founders and HR professionals on building a flexible and scalable recruitment system that can support aggressive business growth.

Keywords: *recruitment strategies, talent acquisition, HR strategy, employer brand, recruitment automation, recruitment, startup*

Introduction

In today's rapidly evolving job market and intense competition for skilled professionals, effective recruitment is becoming a crucial success factor for any organization, especially startups. For a young company in the midst of active growth, the ability to swiftly and efficiently attract the right talent is not merely desirable, but essential. The absence of well-defined hiring procedures can lead to personnel shortages, slow product development, decreased competitiveness, and ultimately, business failure. Many startups face a conundrum: they require new talented employees to expand, yet the lack of a structured recruitment system hinders their ability to attract them, creating a self-perpetuating cycle.

Traditional approaches to recruitment, which are typical for large and long-established companies, often prove to be ineffective or entirely unworkable in a fast-paced startup environment. With a limited budget, a lack of a well-known employer brand, and

the need for adaptable specialists who can handle frequent changes, it's necessary to adopt a fundamentally different approach, one that is more flexible and innovative.

This task is further complicated by the fact that, at the early stages of a startup, there typically are not dedicated HR professionals, and recruitment falls on the shoulders of founders or active team members who may not have specialized expertise in this area.

A startup faces the unique challenge of building a recruitment process from the ground up. This involves not just hiring individuals, but creating a comprehensive and scalable system that can grow with the company. The goal is to attract the best talent and ensure that the recruitment process is both effective and economically feasible.

The system should be integrated into the broader business strategy and take into account the specific needs of a startup. This includes the need for quick decisions, flexibility, and a focus on cultural fit. In this paper, we will explore the key aspects of creating such a system and discuss strategies to ensure the sustainable and dynamic growth of a startup through the formation of a strong team.

Discussion

The history of implementing a recruitment system in a startup is not a linear and unified process, but rather an evolutionary journey that reflects changes in technology, methodology, and understanding of the importance of human capital (Rebrikova N. V., 2021).

At the beginning of the startup movement, especially in Silicon Valley in the 1970s and 1980s, the concept of a "garage" business was just starting to gain popularity. The hiring process was very informal, as startup founders, driven by enthusiasm and limited resources, relied mostly on their personal networks and recommendations from friends and colleagues. Finding someone with a similar vision was a priority, and candidates were evaluated based on their enthusiasm, loyalty to the idea, and ability to work in a high-uncertainty environment. There was no formal system in place – it was more of a chaotic process where personal connections and intuition played a major role.

With the development of the internet and the advent of job boards in the late 1990s and early 2000 s, the search for talent expanded. Startups started to use these platforms to advertise vacancies, allowing them to reach a wider audience. However, this led to an increase in the number of irrelevant applications, requiring primary screening.

At this time, there was a realization of the need for structure in the process, including writing clearer job descriptions and conducting standardized interviews. Despite this, many startups continued to operate without dedicated HR professionals, with recruiting often being handled by technical managers or founders, who spent a significant amount of time reviewing applications and conducting interviews. The first solutions appeared in the form of spreadsheets to track candidates and template emails.

The era of Web 2.0 and the rise of social media in the mid-2000s marked a significant milestone. LinkedIn, Twitter, and other platforms became powerful tools for recruiting in the "future". Startups began to actively use these platforms for direct candidate search, building an employer brand, and interacting with potential applicants.

The concept of a "passive candidate" has become relevant, and recruitment methods have changed. Now, it is not enough to simply wait for feedback; instead, companies must actively "hunt" for talent. During this time, many fast-growing startups realized the need for hiring the first human resources (HR) specialists to systematize the recruitment process. As a result, low-cost applicant tracking systems (ATS), programs that automate routine tasks and centralize information, have emerged (Pisarevskaya, A. I., 2015; Rozanova, V. A., 2016).

From the 2010 s until today, the recruitment process in startups has seen significant changes, shifting from a reactive approach to a proactive, strategic one. In the face of the increasing "war for talent", startups have begun to compete not only on salary and benefits, but also on culture, mission, and opportunities for development.

The rise of artificial intelligence (AI) and machine learning (ML) technologies has led to the development of more advanced applicant tracking systems (ATS), predictive analytics tools, and chatbots for initial screening, as well as virtual assistants. A great deal of

attention is also paid to the candidate experience, so that even when a candidate is rejected, they do not leave with a negative impression (Table 1).

Table 1. *Artificial intelligence in recruiting (Stoilkovska A., Ilieva J., Jakowski S., 2015)*

No.	Indicator	Characteristic
1.	The use of AI in recruiting	Automated resume selection: AI can analyze a large number of resumes and identify the most suitable candidates based on specified criteria. Chatbots: These are used for initial communication with candidates, answering questions, and scheduling interviews. Data analysis: Using algorithms, we can evaluate a candidate's skills and predict their performance based on historical data.
2.	Advantages of using AI	Speed and efficiency: A significant reduction in the time required to select candidates Reducing bias: Algorithms can help minimize the impact of human bias, if they are configured correctly Improving hiring quality: It allows you to more accurately find candidates who fit the company's culture and job requirements
3.	Problems and challenges	Ethical concerns: Potential biases in algorithms based on data. The lack of personal interaction: The risk of oversimplifying the process and losing the human element in recruitment. Reliance on technology: Challenges with the reliability of technology and its impact on decision-making.
4.	The future of AI in recruiting	Further development of technologies like machine learning and neural networks is expected, which will enable even more accurate candidate analysis. The integration of AI with other HR technologies will create a unified talent management ecosystem.

A modern startup that is building a recruitment system from the ground up does not start completely from scratch. Instead, it builds upon decades of accumulated experience, best practices, and technological solutions.

The process now includes not only creating job descriptions and conducting interviews, but also establishing a strong employer brand from the early stages, strategically planning personnel needs, utilizing analytics to optimize the recruitment process, implementing a range of sourcing tools (from referral programs to participating in hackathons), and deeply assessing not only professional skills but also compliance with the startup's cultural values.

Throughout history, each new wave of technological and societal development has presented startups with new tools and approaches, compelling them to continually adapt and innovate their unique methods for attracting and retaining talent amidst constant uncertainty and rapid growth.

Results

It should be noted that the modern construction of a recruiting system from scratch in a startup is not just a hiring process, but a strategic process that begins long before the first vacancy appears. Let's imagine a hypothetical startup developing an innovative technology in the field of quantum computing.

The company starts by defining its DNA and EVP (employee value proposition). The founders formulate the mission, values, and unique culture they want to build. These are not just words, but the foundation that will be broadcast in all recruiting materials. The EVP will include not only a competitive salary and options, but also the opportunity to work on breakthrough technology, flexible schedules, a culture of openness and collaboration, and the ability to grow quickly and influence the product from the start. These aspects are packaged into a convincing "employer branding" that will attract not just candidates, but like-minded people.

Next, the startup begins analyzing the needs and strategically planning for hiring. Unlike in the past, when we would often resort to firefighting, we must now determine in advance which critical roles will be needed to launch a prototype and scale. This includes not only technical roles such as quantum engineers, backend developers, and DevOps specialists, but also roles related to product, such as Product Manager, design, UI/UX designer, marketing, growth marketing specialist, and even an early HR specialist or talent acquisition lead who will help build the team.

After identifying the needs, the startup begins working with channels of attraction. Given the limited budget, the focus is on channels with high conversion rates and low acquisition costs.

1. Referral Programs: Some of the early employees (often founders or their trusted representatives) are actively using their professional networks. A referral program is created (even with rewards for successful recruitment) to encourage referrals.
2. Professional Communities: Active participation in online and offline communities (such as GitHub, Stack Overflow, quantum technology-specific Telegram channels, and specialized conferences and meetups) is encouraged. The founders and key employees act as experts, sharing knowledge and increasing awareness of the startup, while attracting talent. Content about the company's technology and culture is created.
3. LinkedIn and other social networks: Instead of simply posting job vacancies, the recruiter or the founder actively engages in "outsourcing", searching for and contacting potential candidates who match the requirements. Personalized messages and personalization are given attention.
4. Specialized platforms for startups: The use of platforms like AngelList, Habr Career, and regional startup hubs where applicants actively seek work in startups is encouraged.
5. Collaboration with universities and student programs: Given the innovative nature of the field, cooperation with universities is possible, offering internships and diploma projects for talented students to form a strategic talent pool.

This is followed by the development of an effective selection process. The process includes the following stages:

1. Resume screening. Primary screening for compliance with key requirements and cultural values. Automated tools (such as small ATS or customized tables with automatic ranking) are often used to speed up the process, but the final decision rests with the person reviewing the resume.
2. Initial interview (screening call). Conducted by a recruiter or one of the founders, this stage aims to evaluate motivation, compliance with the EVP, basic skills, and experience.
3. Technical interview/test assignment. Tasks are developed that closely resemble the real challenges the candidate will face in the role. For quantum engineers, this might involve solving a complex problem or designing an architecture.
4. Cultural interview. Assessment of alignment with company values, ability to work in a team, self-learning, and adaptability. In startups, this often involves multiple team members conducting the interview.
5. Final Interview with the Founders. This is an opportunity for the candidate to ask questions of senior management and for the founders to evaluate the candidate's potential and commitment.

The implementation of basic technologies and analytics is crucial. At the beginning, companies can utilize:

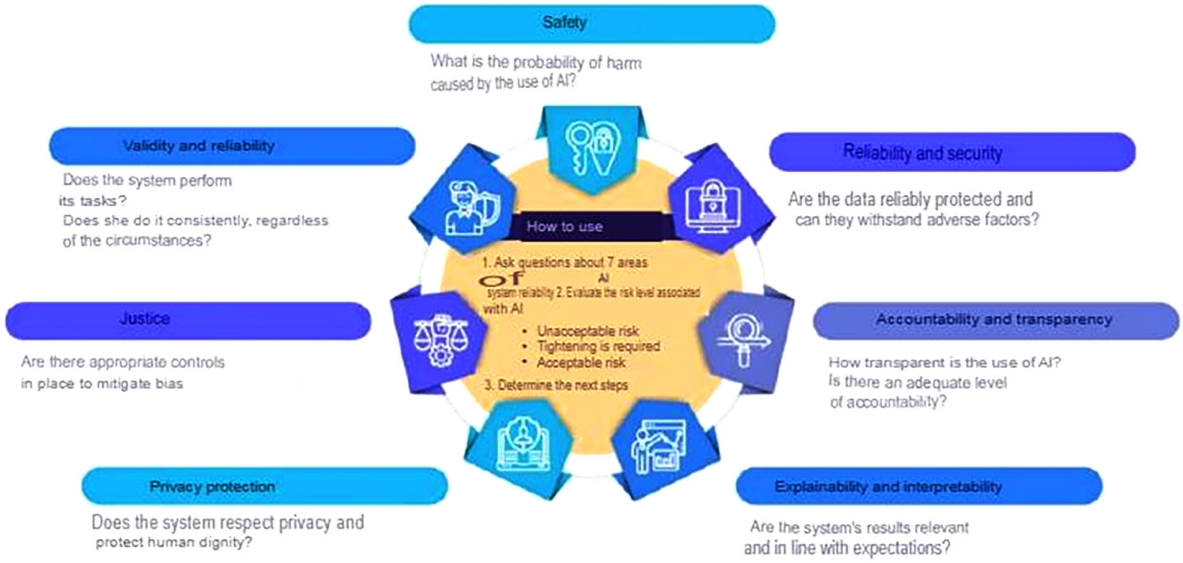
- Free or low-cost ATS (applicant tracking systems) such as Workable (with a free plan), Zoho Recruit, or a customized CRM system for managing candidates. These tools help to centralize information, monitor the status of applicants, and automate communication;
- Interviewing tools like Zoom and Google Meet with recording capabilities (if agreed upon);

– Task management systems like Jira and Trello to organize recruitment stages;
– Basic HR analytics to track metrics such as time to fill a position, hiring sources, and conversions by stage. This helps identify "bottlenecks" and optimize processes.

Feedback and candidate experience become a top priority for companies. They should strive to provide prompt and constructive feedback to all candidates, including those who were not selected, in order to maintain a positive reputation. This includes emails thanking candidates for their participation and messages about the status of their application. These actions help to build the startup's reputation.

As the startup grows, this system may evolve. A dedicated HR department, more sophisticated applicant tracking systems (ATS), AI tools for recruitment and analytics, and employee development programs may be introduced. But it all starts with understanding who the startup wants to attract and why. It's essential to create a focused, effective, and ethical recruitment process to achieve these goals (Fig. 1).

Figure 1. *AI tools for sourcing and analytics*



Conclusions

Thus, building a recruitment system from the ground up in a startup, especially with the goal of rapid scaling, is not just about using tactics, but about a strategic process that is essential to the survival and success of the company. The ability of a startup to execute its ideas, overtake competitors, and adapt to changing market conditions depends directly on the quality and speed of its hiring.

From all of the above, we can conclude that effective recruiting in a startup starts not with searching for candidates, but with understanding your own identity (mission, values, and EVP). This foundation allows you to not only attract the right people, but also filter out those who don't fit the company culture, which can be crucial in the early stages of a startup.

To scale quickly, a recruitment system needs to be flexible, analytical, and technologically advanced. This allows for quick adaptation to changing personnel needs and the dynamic labor market in technological areas.

Analyticity involves constant monitoring of key metrics, such as the rate of job openings, sources of hiring, and conversion at different stages. This helps identify "bottlenecks" and optimizes the recruitment process.

Using modern technologies like ATS (Applicant Tracking Systems), sourcing tools and automation of communications in the early stages, helps minimize routine tasks and focus on more important aspects, such as building relationships with candidates and creating a strong employer brand.

Special attention should be paid to the employer's brand and the candidate's expe-

rience. When it comes to competing for talent, especially in innovative fields, a startup may not be able to compete with large corporations when it comes to salary. However, they can offer a unique work environment, impactful product, rapid growth opportunities, and the chance to work on groundbreaking technologies.

Creating a positive experience for candidates, even if they are not selected, builds brand loyalty and can lead to future benefits through referrals and repeat business.

Lastly, the most crucial aspect is the active involvement of the entire team, particularly the founders, in the recruitment process. In the early stages, the founders are the primary "salespeople" for the startup's idea and culture. Their involvement in interviews, networking, and personal examples significantly increases the chances of attracting top talent.

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MEDIUM-TERM OPTION STRATEGY SIMULATION AND EVALUATION IN THE VOLATILITY MARKET: THE POST-PANDEMIC ERA

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Abstract

This investigation examines the performance and risk-adjusted efficiency of five medium-term option trading strategies, such as Covered Call, Protective Put, Straddle, Iron Condor, and Strangle, on three high-volatility stocks: AMD, NVIDIA, and Tesla, from the time period 2021 till 2024. In the investigation of profitability, volatility, and consistency under a multitude of market situations, including post-pandemic volatility and volatility regime shifts, the study simulates 90-day holding strategies with rolling 30-day periods using the Black-Scholes-Merton model. However, in the result, the iron condor performed better than all the investigated strategies at all times. In the overall conclusion, the findings provide practical suggestions for institutional investors and investment professionals looking for the most advantageous risk-return trade-offs, highlighting the Iron Condor's resilience as the most balanced and risk-efficient trading strategy for medium-term trading in volatile markets.

Keywords: *Option Trading, Volatile Market, Trading Strategies, Simulation*

1. Introduction

Since the global financial market has grown exceptionally volatile in recent decades, investors have become increasingly interested regarding utilizing derivatives as tools rather than solely focusing on the stocks and bonds for risk management and speculation. The volatility of the global financial market has become one of its defining distinctive characteristics, especially in the post-COVID period, which was followed by geopolitical tensions and trade/tariff wars among the main economies, including the United States, China, India, and the European Union. Although option trading has been around since centuries ago and used in different market, it emerged in popularity in the global financial market after the establishment of Chicago Board Options Exchange (CBOE) (Smith Jr. C. W., 1976). Option has been defined by several researchers but most acceptable definition has been given by Black & Scholes, (1973), and defined as

"Financial derivative contract that grants the buyer the right but not the obligation, to buy or sell an underlying asset at predefined price (strike price) on or before the predefined date."

However, researchers also outlined certain difference between the American options and European Options based on the right to sell the option on specified dates. Although, options are one of the most complicated derivatives of the financial market. Options derives their values from different keys factors which includes assets' price, time period of contract, risk free interest rate, volatility and dividend yields (Black & Scholes, 1973; Merton R. C., 1976). The duration of the contract can be used to categorize option trading; in recent years, professionals and researchers have conducted in-depth research on short-term option trading.

Nevertheless, medium-term option trading strategies have not been well investigated; for this reason, this study paper focuses on medium-term option strategies, which usually last between thirty and one hundred sixty days. This research study contributes to understanding the behavior and correlation of equity medium-term options strategies with the volatility of the market. Considering medium term option trading strategies gives a balanced approach between the rapid growth of short-term trading and the patience needed for long-term investing, medium-term option strategies appeal to traders with a risk appetite and patience. These strategies are appropriate for traders those intend to profit from fluctuations in the market without taking on excessive risk or time commitment because they offer flexibility, cost effectiveness, and less stress. Option trading strategies are of greater interest to institutional investors, asset managers, and hedge funds who must balance the trade-offs of time decay, volatility, and transaction cost (Bollen, & Whaley, 2004). Their performance is quite susceptible to market fluctuations, though, which makes them an important subject to research, particularly during erratic market times.

In the previous literature, researchers provided valuable insights into the pricing and performance of various option strategies. However, there remains a gap in comprehensive empirical analyses of multiple medium-term option strategies under the Black-Scholes framework, particularly in volatile market conditions. This study addresses that gap by simulating the performance of covered call, protective put, straddle, iron condor, and butterfly spread strategies using historical data and Black-Scholes pricing. The analysis is conducted across different assets and benchmarked against VIX indices, offering a practical and robust evaluation of strategy effectiveness in medium-term, volatile market contexts. In this paper, we explore how medium-term options strategies behave in a volatile market. By testing different strategies on real historical data and evaluating their outcomes, we aim to find which approaches are more effective and under what conditions they provide the most effective outcomes.

2. Theoretical Background

In the changing landscape of the financial market, investors and institution are looking for the versatile financial instruments of the risk management. Option is such instruments that reduce the risk of the direct exposure to underlying assets but get influenced by the market volatility, which multiplies the opportunities but mutually impose higher risk. If we analyzed the trend in the option trading, during the covid pandemic sharp upward trends has been observed peaking at 48% in the July, 2022 (NYSE), moreover, similar pattern has been observed in the consecutive years. However, in the 2025, markets face recurring structural volatility driven by geopolitical tension, tariff wars, supply chain disruption and so forth, which drives uncertain risk but come up along with the opportunities. Thus, analysis and modeling of the medium-term option trading become more crucial in the current time, which helps the investors and investing institution in the maximization of the investment's outcomes. The foundation of options analysis lies upon pricing models which helps in determining the theoretical and statistical value of the options. There have been several models used by the researchers in the literature. In this section we will discuss the Black Scholes Model introduced by Fischer Black, Myron Scholes (1973).

Black Scholes Model also known as Black-Scholes-Merton Model developed by Fischer Black, Myron Scholes (1973), primarily used to calculate the theoretical price of European-style options and further for the

other financial derivatives, but later expanded by Robert Merton. It provides a formula to determine the fair price of an option based on various factors like the underlying asset price, strike price, time to expiration, interest rates, and volatility (Coelen, N. 2002). Moreover, Robert C. Merton irrespective contributed no-arbitrage rules and continuous-time finance to the mathematical rigor which helps in the minimization of the risk (Janková, Z. 2018). A crucial assumption in the Black-Scholes model's derivation was the absence of arbitrage. This model is predicated on frictionless markets, lognormal asset prices, and constant volatility. Despite criticism for its oversimplifying assumptions, the Black-Scholes model is still an efficient instrument in both academic and industrial settings, especially for strategy, simulation and benchmarking. However, this model also has certain drawback as the differential equation that simulates the pricing process of the underlying asset of a particular option serves as the foundation for the Black-Scholes model. When compared to actual market data, it is immediately evident that the simplifying features suggested by these assumptions such as a continuous process or normal distribution frequently fail inadequate to compare (Embrechts et al., 1999).

2.1 Review on Option Strategies

Options strategies engage with call and put options to achieve certain investing objectives, such as generating income and profit, speculating on fluctuations in the markets, and hedging risk. As stated by previous research, several scholars have examined the performance of various choice strategies under diverse market circumstances (Shalini & Duraipandian, 2014; Guo & Loeper, 2020; Kawadkar & Kadu, 2022; Shivaprasad et al. 2022). Table 1 lists some of the most popular tactics employed by different investors with varying degrees of expertise, along with a definition. Evaluating the performance, theoretical foundations, and empirical efficiency of the various options strategies is crucial for researchers and investors.

Table 1. *Definitions of the major common option strategies*

Option trading Strategies	Definition	Reference
Covered Call	Investors to create premium income and lower cost basis, buy the underlying stock and sell a call option against it. This strategy is appropriate for neutral to slightly positive viewpoints with capped upside. It is described as providing equity like return with lower volatility.	Diaz & Kwon, 2017; Israelov, et al. 2017
Married Put (Protective Put)	To protect against downside risk, buy shares and a put option; losses are limited to the premium cost and rewards are calculated as stock gains less the premium.	Bates, D. S. 2000
Bull Call Spread	It is a vertical options strategy that involves buying a call option with a lower strike price and selling a call option with a higher strike price at the same time. Both options have the same expiration date and resulting in a net debit.	Bakshi et al. 1997; Heinemann, A., 2008
Bear Put Spread	It is a vertical options strategy where a put option with a higher strike price is bought and a put option with a lower price for the strike is traded at the same time. Both options have the same expiration date and result in a net debit.	Figlewski, S. 1989; Slivka et al., 2020
Protective Collar	It is strategies that investor has to offset expenses, sell an out-of-the-money (OTM) call, hold the underlying stock, and purchase an OTM put for protection. It limits downside risk and locks in possible profits by creating a range-bound position.	Merton, R. C. 1971; Santa-Clara, & Saretto, 2009

Option trading Strategies	Definition	Reference
Long Straddle	It is type of a non-directional options strategy in which two options are concurrently acquired on the precise same underlying asset, with a single expiration date and strike price (usually at-the-money, or ATM).	Cheffa, & Shamsa, 2022; Rustamov et al. 2024
Long Strangle	An out-of-the-money (OTM) call and an OTM put option on the same underlying asset are simultaneously purchased using the long strangle non-directional options strategy. The options have the same expiration date but different strike prices.	Nawalkha, & Chambers, 1995; Hebert, A., 2018
Long Call Butterfly Spread	It is a neutral strategy in option trading where one ITM call option is purchased, two ATM call options are sold, and the one OTM call option is purchased. All the options have the same expiration date and are equal distance apart in price.	Black, & Scholes,1973; Bakshi, et al., 1997; Hebert, A. 2018
Iron Condor	It is a neutral options strategy that involves selling an OTM (out of the money) put spread and an OTM call spread on the same underlying asset with the same expiration date.	Figlewski, S. (1989); Hebert, A. (2018); Kownatzki, & Sabouni,(2019).
Iron Butterfly	It is a neutral options strategy that involves selling an ATM straddle, which consists of an ATM call and an ATM put with the same strike price, as well as an ONM call and an OTM put for protection, all of which have the same expiration.	Figlewski, S. (1989); Hebert, A. 2018

A substantial number of options strategy research has focused on daily or short-term option strategies. The scientific research on options based on a medium-term time frame is far less extensive. Institutional investors frequently select options with monthly or quarterly expiration dates because they offer the best combination of reduced costs, improved liquidity, and flexibility to respond to changing market conditions. By avoiding the rapid fluctuations in prices (gamma risk) of less-than-weekly options, an institutional investor can employ medium-term options to predict overall market movement.

In conclusion, the literature highlights concern within the absence of thorough empirical research on a number of medium-term option strategy structures under the Black-Scholes price framework in volatile markets. The research question "*Which medium term options trading strategy performed the best in the medium-term volatile market?*" was naturally prompted by discussion.

3. Methodology

3.1 Data Collection

We construct our dataset from historical daily closing prices for five different assets for NVIDIA (NVDA), AMD, and Tesla (TSLA) volatility index. The data spans from January 1, 2021 to December 31, 2024, covering a period with noticeable market volatility. The data was gathered for both the pandemic and the post-pandemic recovery periods. The majority of businesses underperformed and saw unfavorable fluctuations during the pandemic. Stock data was collected from reliable financial sources such as Yahoo Finance and http://investing.com/, and all data was cleaned to remove missing or inconsistent values. To analyses strategy performance, we also calculated rolling historical volatility using a 30-day window and used it as an input for option pricing.

3.2 Historical Volatility, Log Returns and Annualized Volatility Analysis

To evaluate the behaviour of the underlying assets, it is essential to analyse their log-

arithmic returns and historical volatility over time. These measures help quantify both the direction and the magnitude of asset price movements, which are critical inputs for options pricing and strategy simulations.

- **Log returns** (or continuously compounded returns) are preferred in financial modelling due to their time-additive property and their ability to handle large variations in asset prices;
- **Historical volatility** measures the dispersion of returns over a specific period (e.g., 30 days), offering a backward-looking estimate of how volatile the asset has been;
- **Annualized volatility** is a standardized measure of the dispersion of returns, scaled to a yearly horizon. While historical (or realized) volatility is typically computed over a short-term rolling window (e.g., 30 days), annualizing this measure allows for easier comparison across assets and strategies, regardless of the time frame used for analysis.

The daily log returns were computed as:

$$Log\ \mathrm{Re}turn_t = \ln\left(\frac{P_t}{P_t - 1}\right)$$

where P_t is the closing price on day t. Visual inspection of the time series of log returns reveals:

- Frequent short-term fluctuations with occasional extreme spikes (both positive and negative);
- Clustering behaviour – periods of high volatility tend to be followed by similar periods;
- No clear upward or downward trend, indicating returns are centred around a mean close to zero.

To analyse short-term market risk, we computed the 30-day rolling historical volatility, defined as:

$$\sigma = std(\log returns) \times \sqrt{252}$$

Annualized volatility expresses how much an asset's price is expected to fluctuate over a year, based on its recent short-term return behaviour.

$$\sigma_{annual} = \sigma_t \times \sqrt{T}$$

Where:

- σ_t = Rolling standard deviation of daily log returns;
- T = Number of trading periods in a year (252 for daily data).

3.2.1 Lack Scholes Option Pricing Model

The **Black-Scholes Model (BSM)**, developed by Black, Scholes, and Merton, provides a closed-form method for pricing European options. In this study, BSM is applied to strategies like Covered Call, Protective Put, Straddle, Iron Condor, and Strangle for AMD, NVIDIA, and TESLA. Historical volatility (σ) is derived from daily stock prices, and the risk-free rate from U. S. Treasury yields. Option prices are programmatically computed using the BSM to simulate trades, evaluate returns, and compare strategy performance across varying volatility regimes.

3.3 Implementation of the Black Scholes Model

To practically apply the Black-Scholes Model (BSM) in this research, the pricing formula was implemented in Python using standard libraries such as numpy, scipy.stats, and pandas. The model was used to compute theoretical prices for both **call** and **put options**, which then served as the foundation for simulating returns across different option trading strategies.

The Black-Scholes formulas for pricing European call and put options are given by:

$$C = S_0 \cdot N(d_1) - Ke^{-rT} \cdot N(d_2)$$

$$P = Ke^{-rT} \cdot N(-d_2) - S_0 \cdot N(-d_1)$$

Where:

$$d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}},$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

- C, P: Call and put option prices;
- S_0: Current stock price;
- K: Strike price;
- r: Risk-free interest rate;
- T: Time to maturity (in years);
- σ: Annualized volatility of the underlying asset;

- *N(d)*: Cumulative distribution function of the standard normal distribution.

4. Result

AMD (Advanced Micro Devices) – AMD's log returns range about zero, indicating neutral daily performance, as seen in Figure 1.1. Sharp spikes indicate market events that cause short-term volatility, whereas volatility clustering represents normal financial behaviour. Variable market risk is shown by the 30-day rolling and annualized volatility, which alternates between stable and stormy periods and peaks above 75%.

NVIDIA – Time-varying risk could be seen in Figure 1.2, where the log returns of NVDA exhibit clear volatility clustering and oscillate around zero. The 30-day rolling and annualized volatility (30–80%) show periods of calm and turbulence that alternate, with peaks occurring during significant market occurrences. NVDA exhibits a high-growth, high-risk pattern overall, with notable spikes in volatility and returns.

TESLA – With apparent volatility clustering and spikes associated with significant events, Figure 1.3 displays TSLA's log returns varying strongly around zero. TSLA's high-risk, event-driven character is reflected in the 30-day rolling and annualized volatility (30–90%), which show sudden regime transitions between stable and tumultuous phases.

Figure 1.

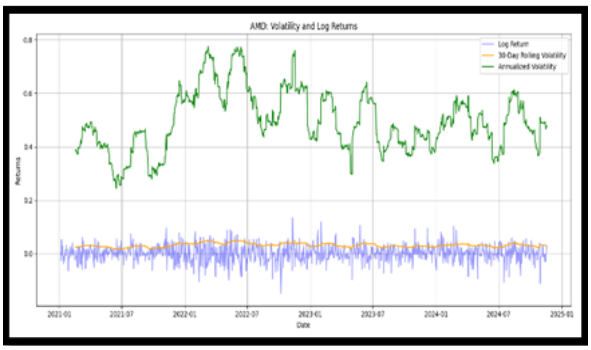


Figure 2.

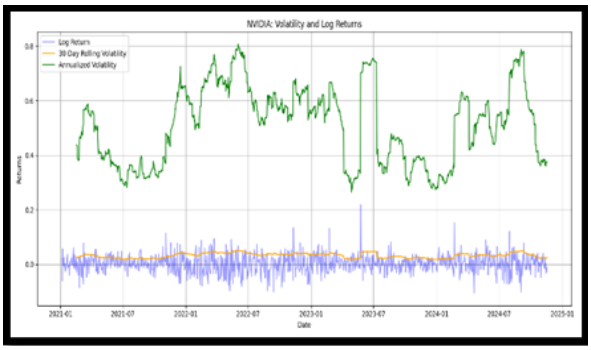


Figure 3.

4.1 Options Strategy Simulation

This section describes how the Black-Scholes Model was used to simulate and model option strategy trading on AMD, NVIDIA, and Tesla based on synthetic prices. The necessary inputs, which included the spot price, ATM strike, risk-free rate, time to maturity, and volatility, were taken from historical data. The simulation parameters and rules were as follows:

- Holding Period: All positions were held for 90 calendar days;
- Rolling Window: A new transaction was created every 30 days;
- There are no taxes, transaction costs, or slippage.

4.1.1 AMD Covered Call Strategy Simulation Analysis

During situations of moderate market volatility, the AMD Covered Call strategy generated consistent gains; nevertheless, during market downturns, it experienced significant losses. It has a left-skewed return distribution, with regular modest gains and sporadic steep

declines. When the VIX was low, performance was at its best since time decay and stable markets increased returns. Premiums were unable to compensate for equity losses under high-VIX regimes, which resulted in larger and frequently negative returns. All things considered, the strategy performs best in quiet markets, and its negative risk is shown by volatility surges. The analysis categorizes the strategy returns into two regimes:

- **High VIX**: Periods of elevated market volatility and fear (typically VIX > 20);
- **Low VIX**: Periods of stable or bullish market sentiment (typically VIX ≤ 20).

Figure 4.

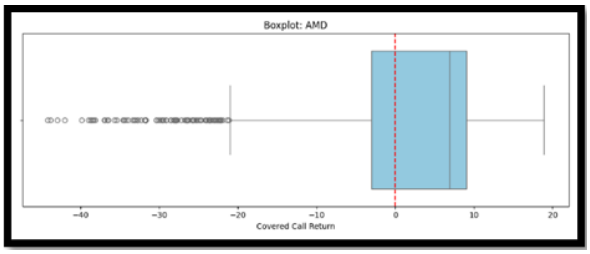


Figure 5.

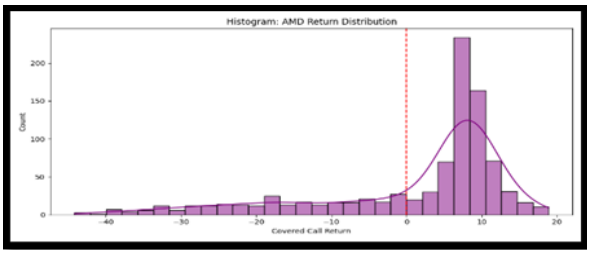


Figure 6.

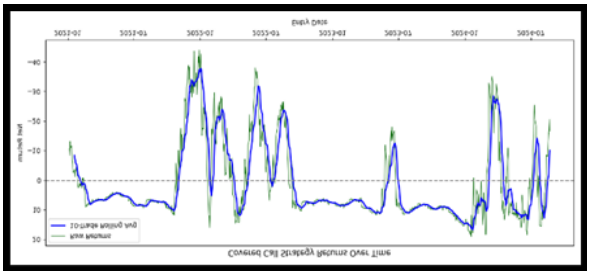
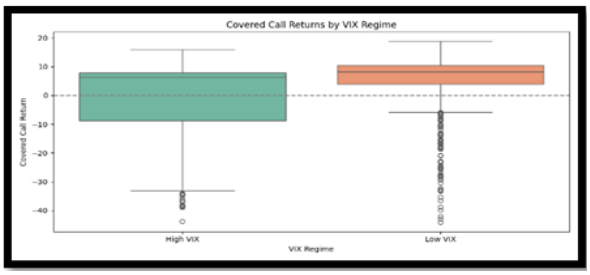


Figure 7.



1.1.2 NVIDIA Covered Call Strategy Simulation Analysis

The returns with the NVIDIA Covered Call strategy were consistently positive biased, with minor drawdowns and frequent profits. It functioned well in bull markets characterized by low volatility, especially the AI-driven rise in 2023, when it recorded significant returns from option premiums and stock appreciation. large-VIX periods, on the opposite side, were erratic and included little losses in the midst of large premiums. Overall, the strategy performed well in controlled, rising markets, demonstrating the importance of strategically selected and volatility-timed stock selection.

Figure 8.

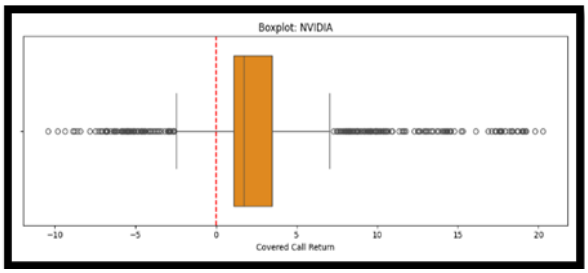


Figure 9.

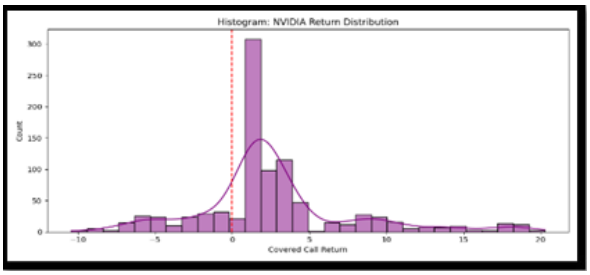


Figure 10.

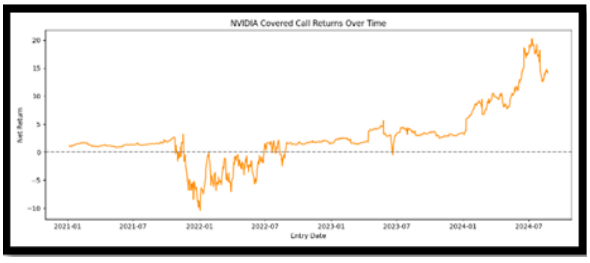
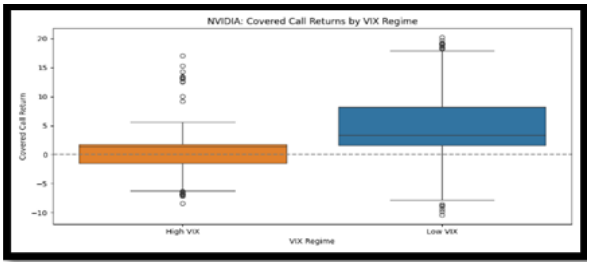


Figure 11.



1.1.3 TESLA Covered Call Strategy Simulation Analysis

In addition to Tesla's extreme volatility, the Tesla Covered Call strategy had a broad, asymmetric return distribution with several small successes and a few large losses of more than –150%. In times of market stress and falling stock prices, such as late 2021 and late 2023, it performed well. However, in 2022 and early 2024, it saw significant drawdowns. Returns in low-VIX regimes were more stable, while downside risk was higher in high-VIX regimes. Although low-volatility markets help the approach overall, hazardous activist management – such as timing entries, hedging, or employing further OTM strikes – is required to curb Tesla's speculation and volatile nature.

Figure 12.

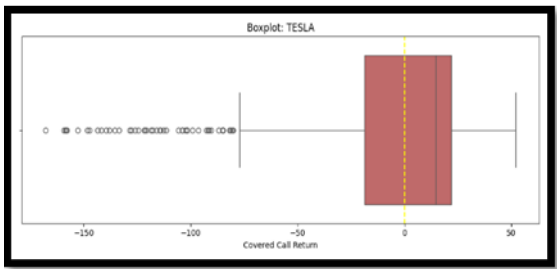


Figure 13.

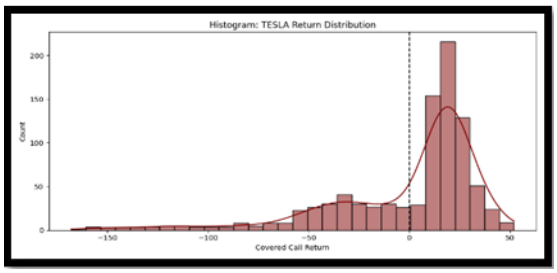
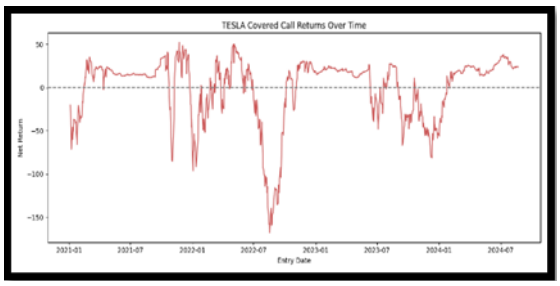


Figure 14.



1.1.4 AMD Protective Put Strategy Simulation Analysis

Figure 15.

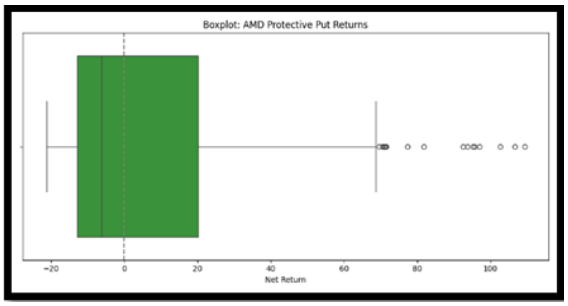


Figure 16.

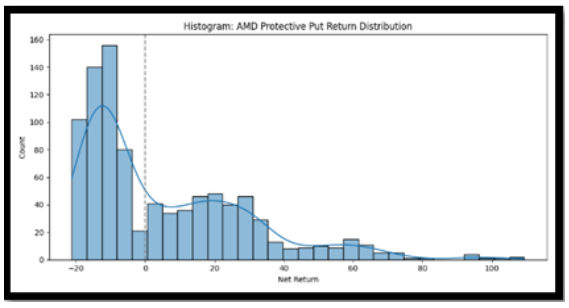
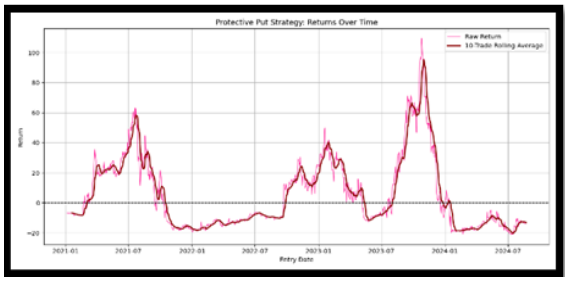


Figure 17.



All things considered, Protective Put works best as a defensive, crisis-hedge tactic rather than as a regular tactic. The AMD Protective Put method is effective in reducing downside risk and distributing gains. Its payouts are right-skewed, with large gains during downtrends and mostly minor losses on the put premium.

The strategy trailed in steady markets due to its premium cost, but it did very well in tumultuous times like late 2021-mid-2022, offering fantastic protection. According to VIX-based study, it functions well in situations with high volatility but inefficiently in those with low VIX. Generally speaking, it works best as a tactical hedge before significant risk occurrences or expected volatility surges.

4.1.5 NVIDIA Protective Put Strategy Simulation Analysis

A right-skewed distribution of returns, with frequent modest gains and few losses, was produced by the Protective Put on NVIDIA, suggesting excellent downside protection and significant upside potential. The majority of returns were between 0% and 20%, with a few losses below –10% and sporadic profits up to 60%. Put costs were helpful insurance during volatility surges, even though they somewhat decreased returns during calm times.

VIX-based strategies demonstrated that, in low-VIX regimes, lower-cost options permitted better returns, while in high-VIX regimes, returns were steady but modest due to the increased cost of protection. Overall, when implemented dynamically in accordance with volatility regimes, NVIDIA's protective put approach offered an alluring risk-return compromise – capital preservation during tumultuous times and return enhancement during stable markets.

Figure 18.

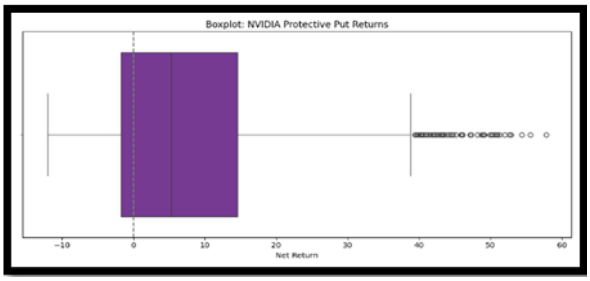


Figure 19.

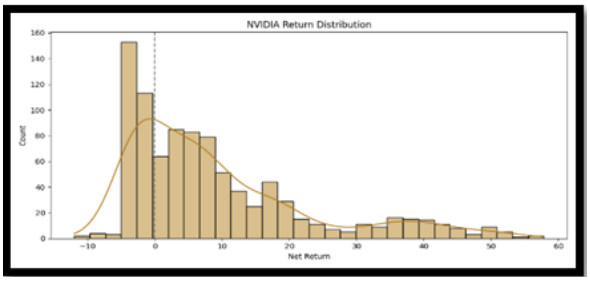


Figure 20.

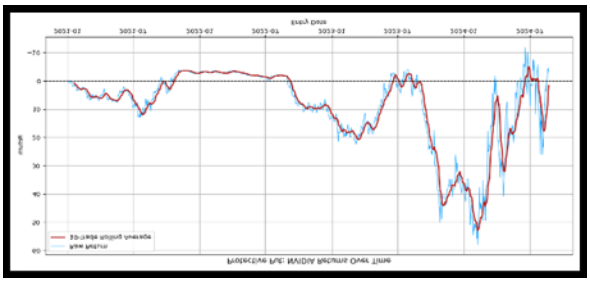
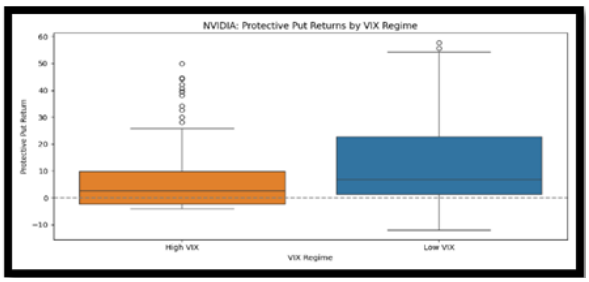


Figure 21.



4.1.6 TESLA Protective Put Strategy Simulation Analysis

A highly volatile, positively skewed return distribution was produced by the Protective Put on Tesla; put costs frequently saw modest losses, but during big rallies, there were sporadic, massive profits of over +200%. It achieved strong upside during rallies like the 2021 EV boom and the 2023–2024 AI-driven rally, and it successfully reduced downside risk during market downturns.

Results varied depending on the VIX regime: low-VIX regimes provided greater, more consistent returns because of less expensive hedging, whereas high-VIX regimes provided robust protection but constrained earnings. All things considered, Tesla's Protective Put strategy, which offers an alluring balance between risk protection and growth participation, worked best when entered ahead of volatility spikes.

Figure 22.

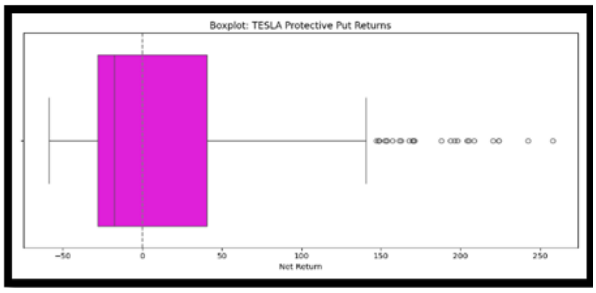


Figure 23.

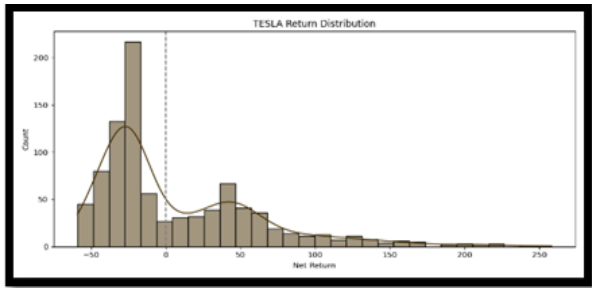


Figure 24.

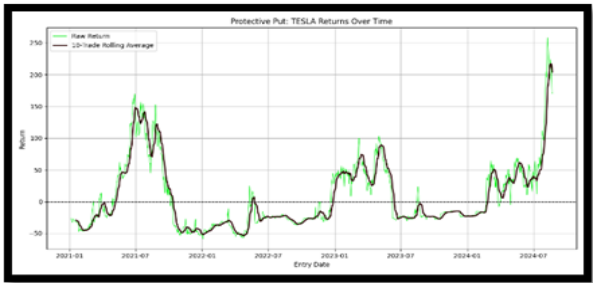
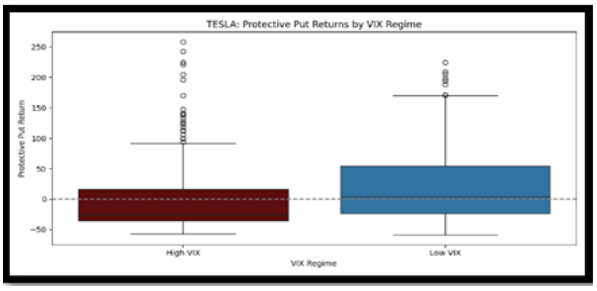


Figure 25.



4.1.7 AMD Straddle Strategy Simulation Analysis

With regular small declines and infrequent significant gains above +60%, the AMD Straddle strategy – both a put and a call held long – had a positively skewed profile of returns. However, it lost money in steady or low-volatility conditions due to option decay, but it did best in turbulent price action, such as the 2023–2024 AI bubble and significant corporate announcements. VIX-based study produced contradictory findings: straddles were less expensive and had greater upside potential when volatility increased in a shock-like fashion during low-VIX periods, while returns were constrained during high-VIX times since volatility was already priced in, resulting in medians of almost zero. All things considered, the straddle strategy for AMD performed best when it was used to take advantage of volatility surges during major earnings, the announcement of new products, or unexpected market shocks.

Figure 26.

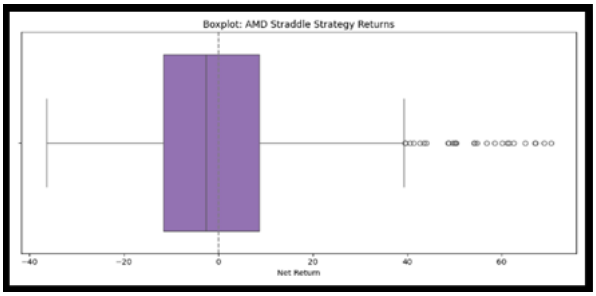


Figure 27.

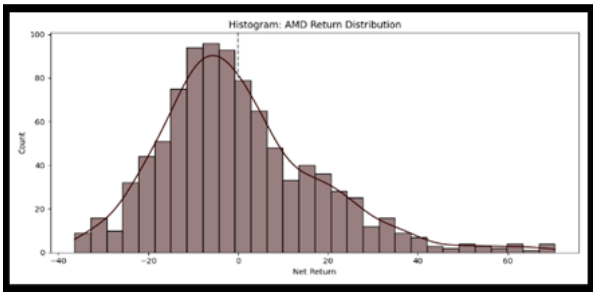


Figure 28.

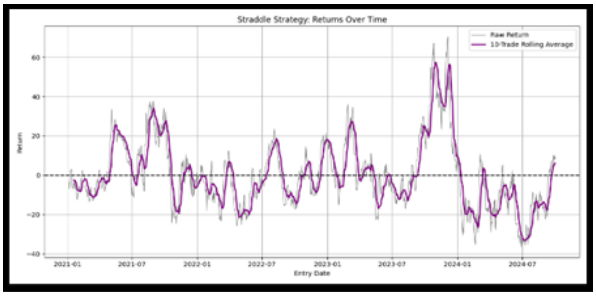
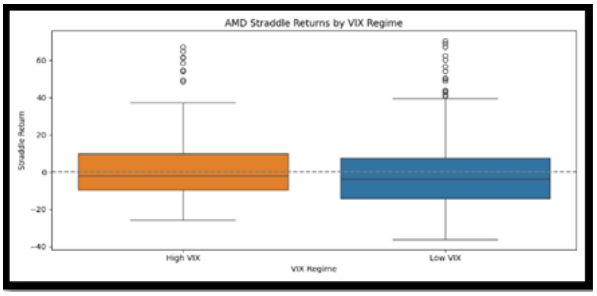


Figure 29.



4.1.8 NVIDIA Straddle Strategy Simulation Analysis

Consistent with symmetric reward behavior, the NVIDIA Straddle method showed

symmetric, near-breakeven returns with a moderately positive median and manageable volatility. Returns were mostly between –10% and +10%, with the rare spike beyond +40% due to significant catalysts like GPU releases or advancements in AI. The AI boom of 2023–2024 saw the best performance when actual volatility exceeded forecasts but then decreased following volatility compression.

According to VIX analysis, when volatility was already built into the price, high-VIX periods offered consistent but moderate returns, while low-VIX times offered more upside potential since options were less expensive and surprise rising volatility produced good profits. In general, NVIDIA's straddle strategy performed best as an event-driven short-term approach when it was used in advance of significant announcements or during periods of market calm when volatility spiked.

Figure 30.

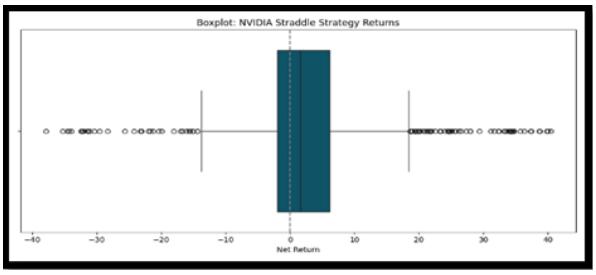


Figure 31.

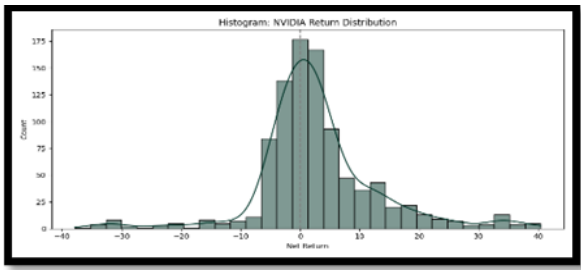
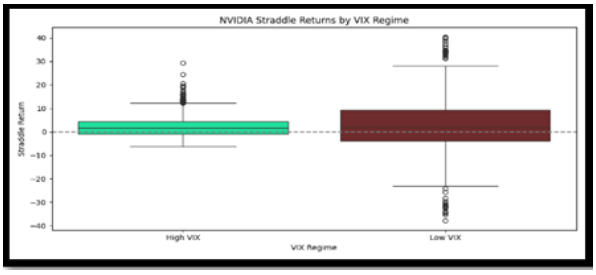


Figure 32.

Figure 33.



4.1.9 TESLA Straddle Strategy Simulation Analysis

With a median close to zero, Tesla's Straddle method yielded wildly erratic results, with too many minor excess losses offset by irregular massive gains of more than +150%.

Figure 34.

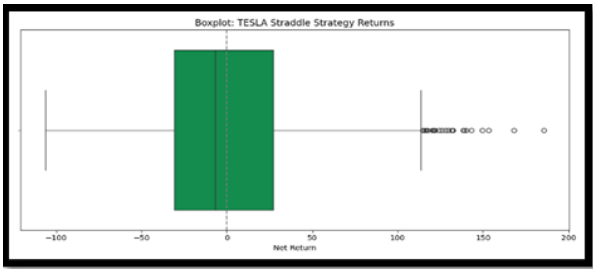


Figure 35.

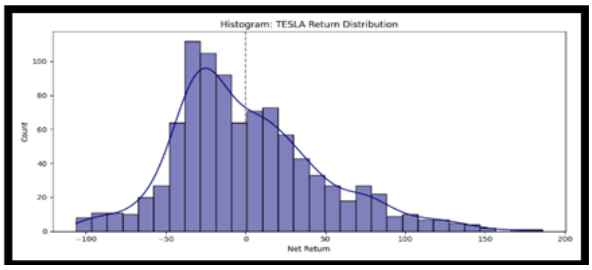


Figure 36.

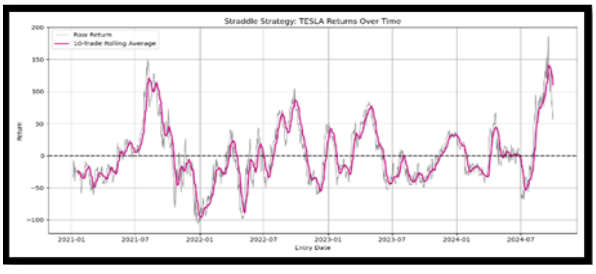
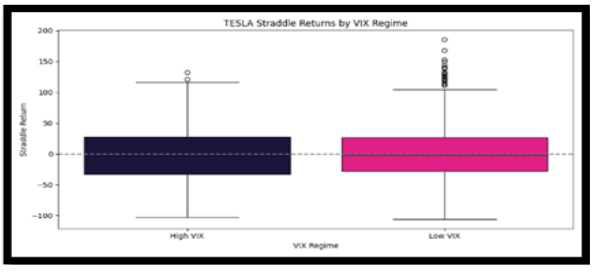


Figure 37.



In flat markets, the majority of transactions resulted in losses ranging from 20 to 70%; however, notable catalysts such as the Tesla founder's remarks, new product launches, or earnings generated sizeable profits. Low-VIX times produced better results with less expensive options and higher reward potential when surprise volatility surfaced, whereas high-VIX periods produced overpriced options and limited upside across all volatility regimes. In general, Tesla's straddle approach performed best prior to significant events when low-VIX conditions produced excellent gains with a remote possibility of a decline.

4.1.10 AMD Iron Condor Strategy Simulation Analysis

Through taking advantage of stable, low-volatility situations, the AMD Iron Condor strategy produced consistent, low-risk gains. On average, gains fluctuated between 1% to 6% and around 3%, while losses were moderate and contained. Performance was unsatisfactory at volatile times, such as late 2021-early 2022, but it significantly improved in 2023–2024 when volatility subsided and AMD fluctuated within a more constrained range.

According to VIX-based statistics, periods with high VIX generated smaller and less reliable returns because of the constant price volatility, whereas periods with low VIX generated more substantial and reliable gains (median 3.5–4%, peak 13%). The Iron Condor generally performed best in calm markets, which supports its use as a cautious income strategy in situations with low volatility and constrained price volatility.

Figure 38.

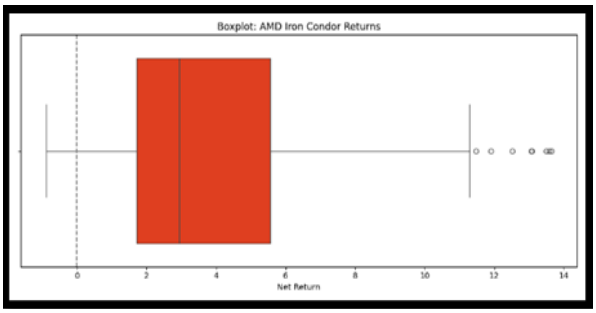
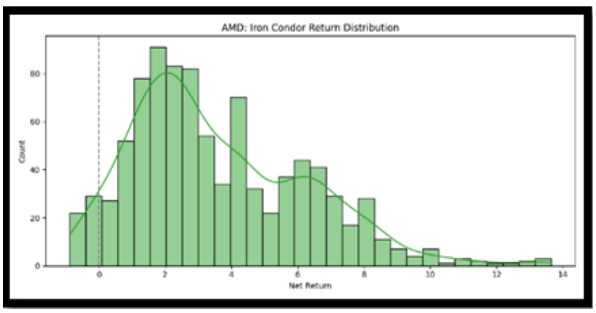


Figure 39.



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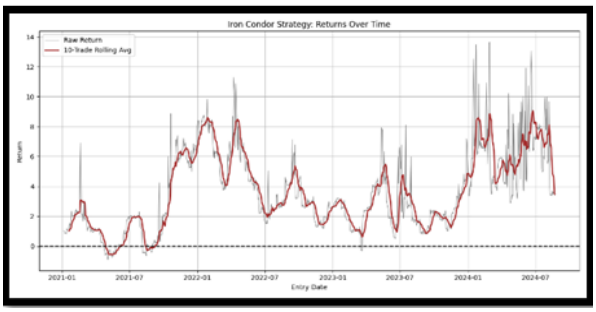
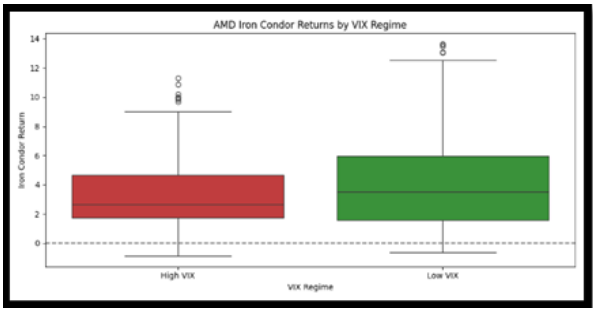


Figure 41.



4.1.11 NVIDIA Iron Condor Strategy Simulation Analysis

The NVIDIA Iron Condor approach led to consistent, low-risk revenues with a limited range and minimal downside. With a median of roughly 1% and occasional outliers exceeding 8%, most trades made between 0.2% and 2% when prices were stable during periods of high implied volatility. The minor losses indicated that exposure caps and risk management were working.

When markets were quiet from 2021 to mid-2024, returns remained stable. However, during NVIDIA's AI-driven rise, when substantial premiums along with regulated fluctuations in prices enhanced profits, returns dramatically improved. Low-VIX periods produced somewhat higher medians (1.3–1.5%) and more upside potential, but they also increased risk from unexpected volatility spikes, according to a VIX-based analysis. On the other hand, more steady but slightly higher profits (around 1%) were generated during high-VIX periods. Overall, NVIDIA's Iron Condor strategy outperformed other low-risk income strategies due

to its reliable operation in stable conditions and careful strike management throughout volatility regimes.

Figure 42.

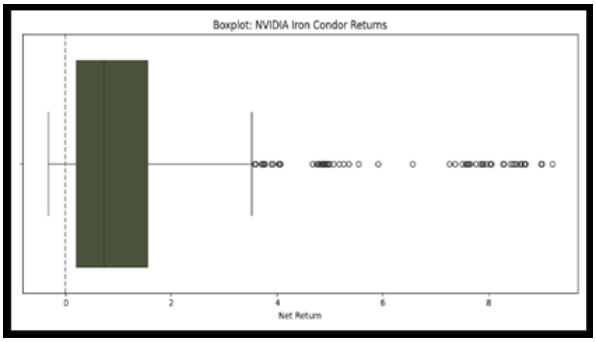


Figure 43.

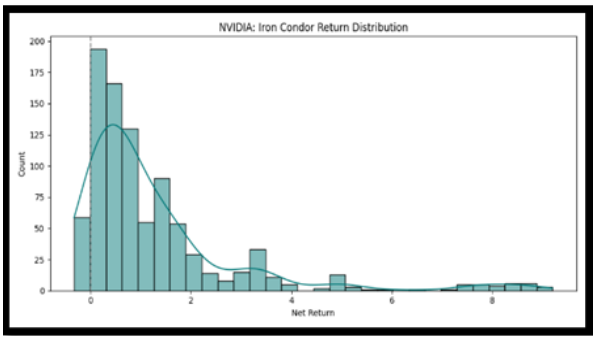


Figure 44.

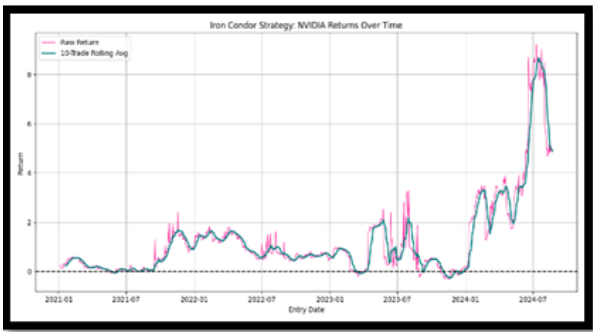
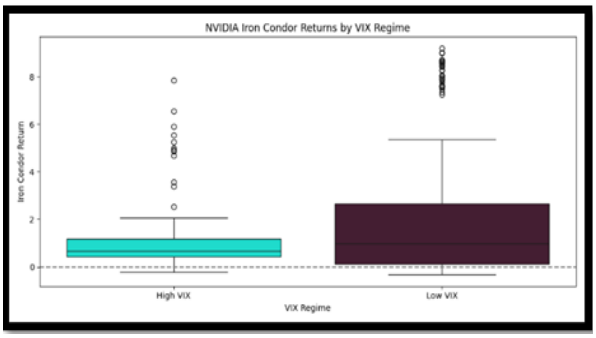


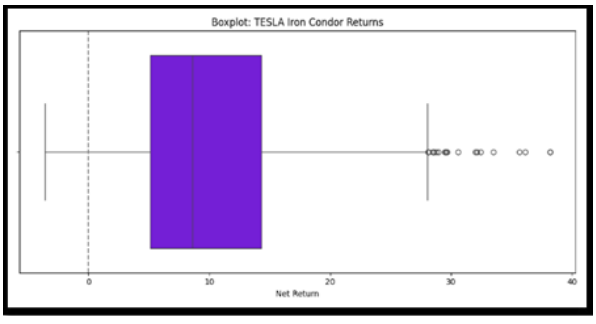
Figure 45.



4.1.12 TESLA Iron Condor Strategy Simulation Analysis

The Tesla Iron Condor strategy brought strong, significantly skewed gains with consistent profitability and limited negative risk. Outliers of 20–30% happened when volatility fell precipitously following trade entry, while the majority of deals made between 4% and 12%, with a median of roughly 7–8%. The tiny and inconsistent losses were indicative of the defined risk attribute of the methodology.

Figure 46.



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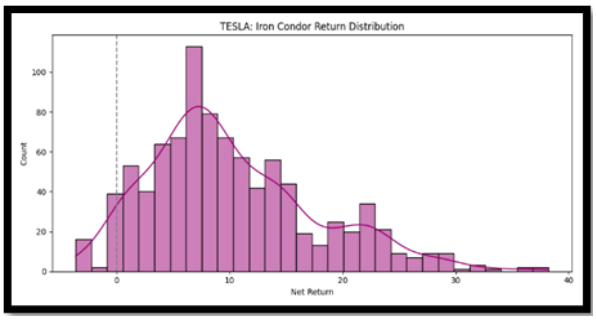


Figure 48.

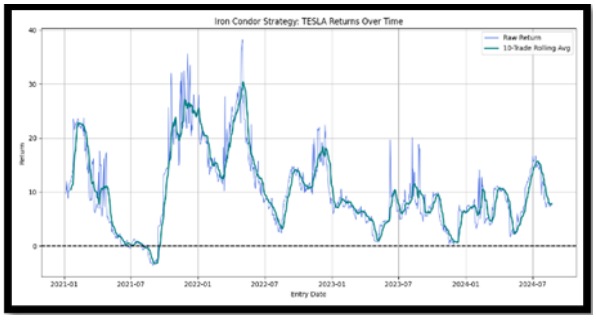
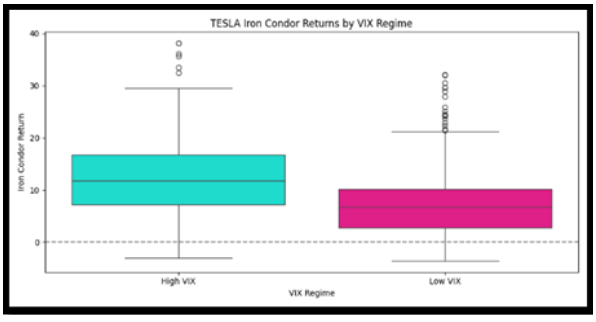


Figure 49.



Performance fluctuated depending to market periods from 2021 to 2024, with losses during 2022 volatility spikes following extraordinarily high returns in early 2021 and late 2021-early 2022 during post-earnings stability. As Tesla fluctuated in shorter ranges, the approach recovered through 2023–2024, yielding a consistent 5–15% return. With all aspects considered, Tesla's Iron Condor strategy performed optimally whenever structured around volatility reversals, providing predictable profits during quiet, range-bound periods and high-income potential in extremely volatile markets. According to VIX-based analysis, low-VIX periods generated lesser but more consistent gains (median ~6%), but carried a higher breach risk during unexpected volatility spikes. In contrast, high-VIX periods generated larger but more variable profits (median ~12%, IQR 6–18%) because of higher premiums and wider strike ranges, which benefited from volatility mean reversion.

4.1.13 AMD Strangle Strategy Simulation Analysis

The AMD Strangle strategy executed an extremely beneficially skewed return profile with limited downside and significant upside potential. The majority of trades were profitable and with a positive average and regular moderate gains between 0% and 50%, while there were a few exceptions during notable price spikes, such as the 2023–2024 AI chip bubble, that saw prices rise by over 600%. The option premium restricted small and marginal losses. From 2021 to 2024, performance varied according to market conditions, with large gains during bullish or volatile market times, poorer results in range-bound markets, and peak profitability during times that included substantial volatility expansions.

Low-VIX periods enabled more feasible entries and more upside potential, but premium decay was more probable when volatility was light, according to VIX-based study. High-VIX periods, on the other hand, yielded more reliable but moderate results, necessitating large price swings to offset expensive premiums. AMD's strangle strategy, which balanced breakout potential and cost effectiveness using VIX filters, typically worked best when applied before notable catalysts or volatility expansions.

Figure 51.

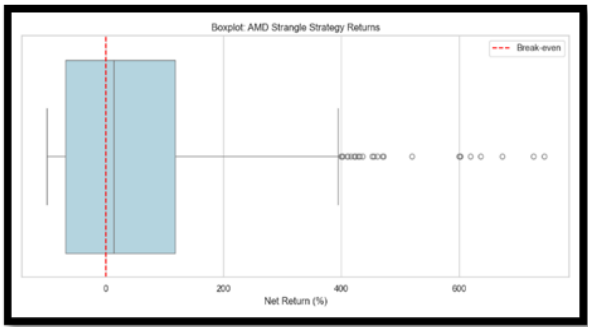
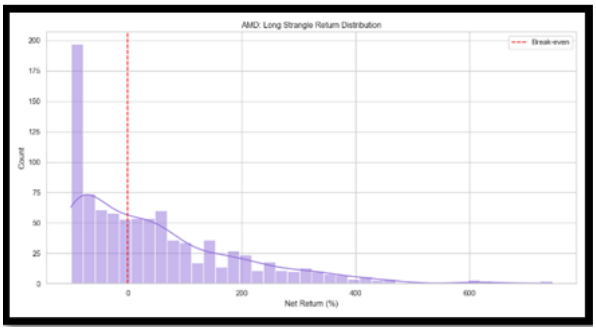


Figure 52.



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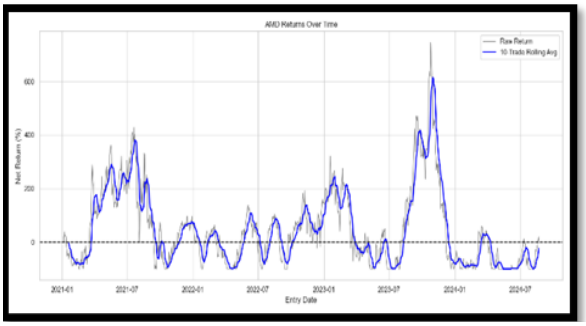
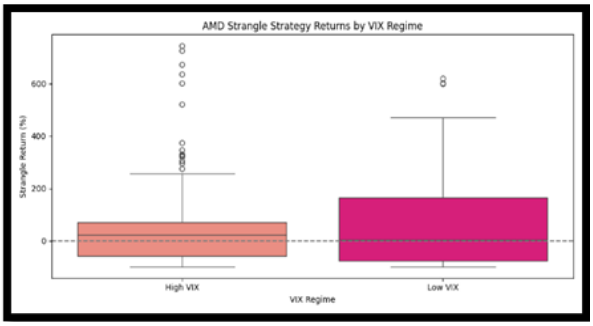


Figure 54.



4.1.14 NVIDIA Strangle Strategy Simulation Analysis

The NVIDIA Strangle strategy generates a highly unpredictable, right-skewed return

distribution with substantial upside potential and relatively little risk. While the majority of transactions resulted in moderate gains or losses, a few rare outliers – some exceeding 1,000%—driven overall performance, especially around important triggers like earnings and AI-related announcements. Performance increased during high-volatility and event-driven stages, particularly the 2023–2024 AI boom, while returns dropped during low-movement periods as option premiums decreased between 2021 and 2024.

According to VIX-based analysis, low-VIX circumstances generated the optimum cost-reward ratio; in the event of an unexpected volatility surge, lower-priced options offered a bigger potential profit. Conversely, high-VIX eras produced lower and less reliable returns since inflated premiums required disproportionately significant price swings for profit. According to research, NVIDIA's strangle strategy – which combined rigorous risk management with volatility analysis to capitalize on unforeseen market expansions performed best when deliberately implemented during low-volatility times before major catalysts.

Figure 55.

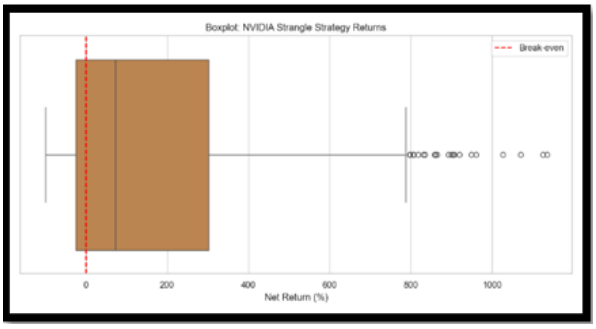


Figure 56.

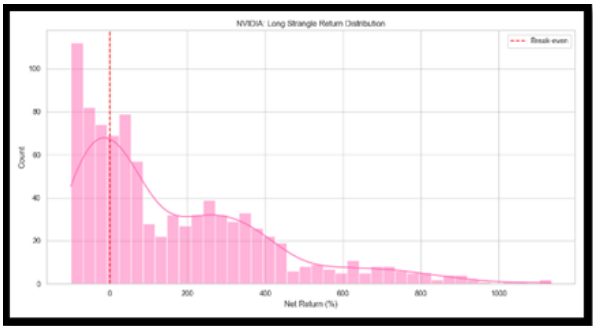


Figure 57.

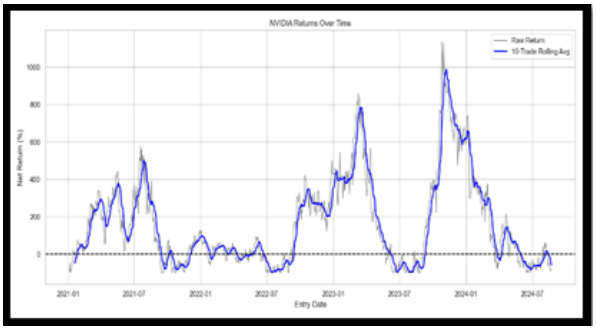
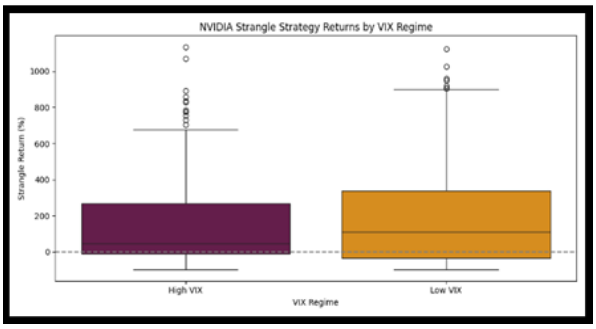


Figure 58.



4.1.15 TESLA Strangle Strategy Simulation Analysis

The Tesla Strangle strategy generated a slightly skewed return distribution with a moderately positive median, and multiple slight losses or breakeven transactions offsetting occasionally enormous profits over 700%. Considering Tesla's volatility and asymmetric dividend approach, most returns ranged from –75% to +200%. Profits were concentrated around important events like Musk's statements, product upgrades, or earnings reports, whereas time decay losses were caused by range-bound periods.

VIX-based research indicates that whereas high-VIX times generally resulted in negative returns resulting from expensive premiums and post-volatility decreases, low-VIX periods offered better performance with less expensive options and more potential from unanticipated volatility fluctuations. Generally speaking, Tesla's strangle strategy performed best when applied strategically at times of low volatility, ahead of important triggers. This reduced the chance of dropping prices and enabled traders to profit from large, event-driven price changes.

Figure 59.

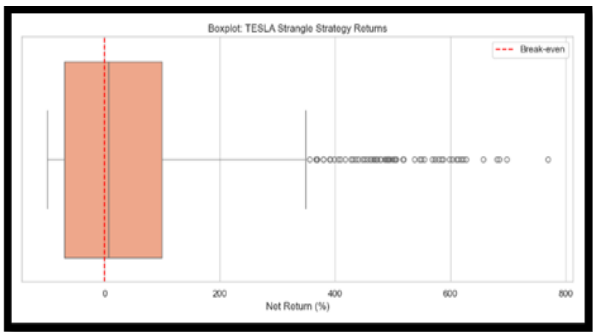
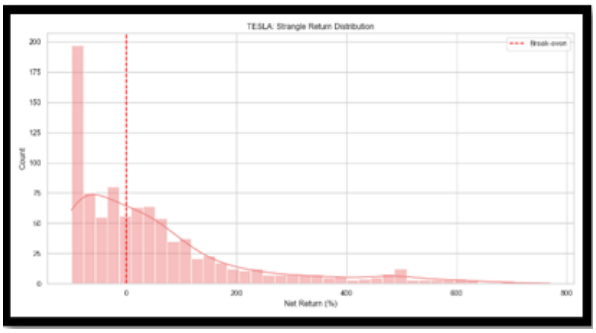


Figure 60.



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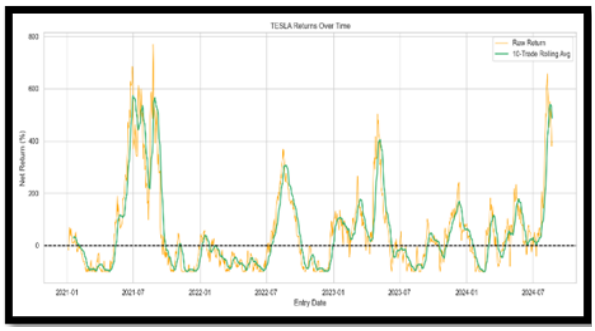
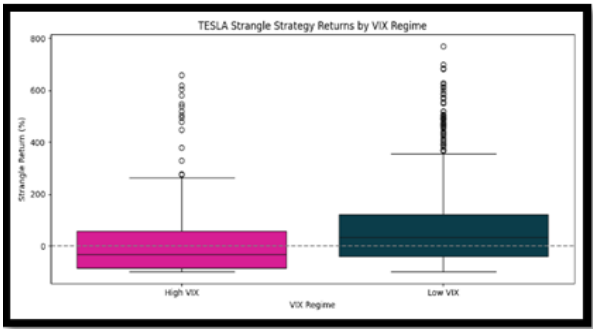


Figure 62.



4.2 Performance Metrics

Several critical performance indicators have been used to assess the efficacy of the strangle, iron condor, and straddle strategies throughout different stock markets and volatility regimes. These offer an equitable assessment of consistency, risk, and profitability.

Table

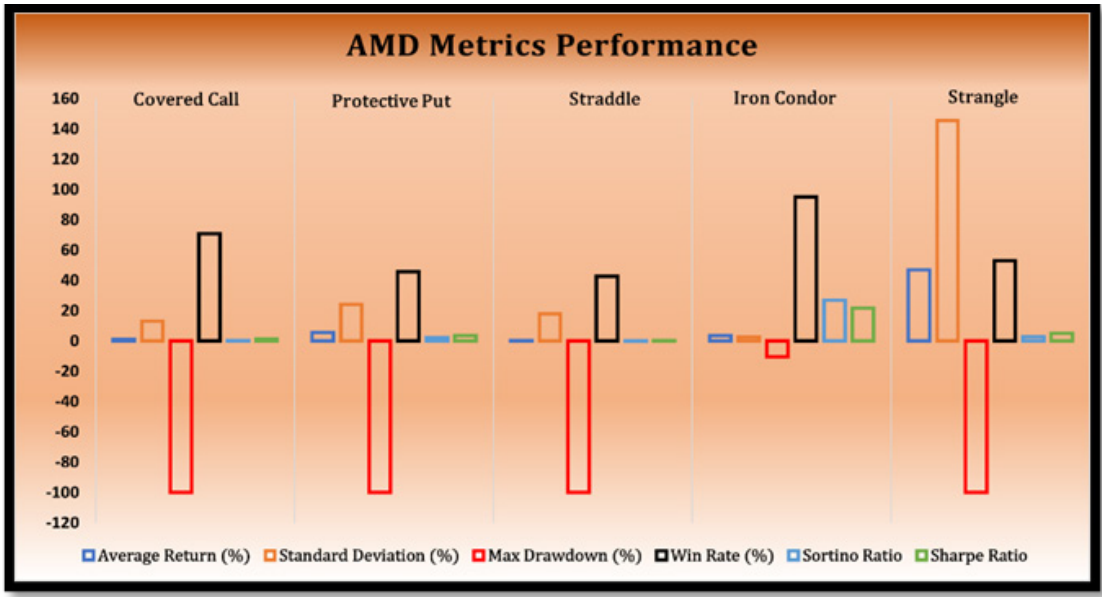
Average Return	The average percentage return across all trades has been referred to as the «average return.» Overall profitability is displayed, but the constancy of returns is not.
Standard Deviation	Measures the volatility of returns. A higher value indicates greater risk and uncertainty in performance.
Maximum Drawdown	Shows the greatest drop in value and possible money at risk, and it collects the largest loss from peak to trough.
Win Rate	Indicates the percentage of profitable trades among all trades and the consistency with which a strategy produces gains
Sharpe Ratio	Risk-adjusted returns determined by dividing total volatility by excess return. The higher the ratio, the more successful it is in producing returns for the risk assumed.
Sortino Ratio	since it only considers downside volatility, it is comparable to the Sharpe Ratio and is therefore better suited for asymmetric return techniques such as options. Better management of downside risk is indicated by a greater ratio.

4.3 AMD Performance Metrics Analysis

The Iron Condor proved among the most balanced and stable of the five methods that were investigated: Covered Call, Protective Put, Straddle, and Strangle. With consistent and effective performance, it offered the highest possible risk-adjusted values (Sharpe 21.6, Sortino 27), a foremost 95.2% winning ratio, and modest returns (3.61%) with exceptionally low volatility (2.65%).

Although market-exposed on the downside, the Covered Call is a reliable income strategy that consistently generated modest returns (1.09%) with little volatility. The Protective Put, an effective approach for risk-averse investors seeking hedged exposure, performed well in terms of downside protection and offered fair risk-adjusted returns with a reduced win rate. A high-risk, significant-reward strategy predicated on recurring significant swings, the Strangle generated very high average returns (47%) but also extremely high volatility (145%) and total drawdowns. Subsequently, the Straddle showed poor performance with excessive volatility and low returns (0.14%), proving its worthlessness without accurate volatility estimates.

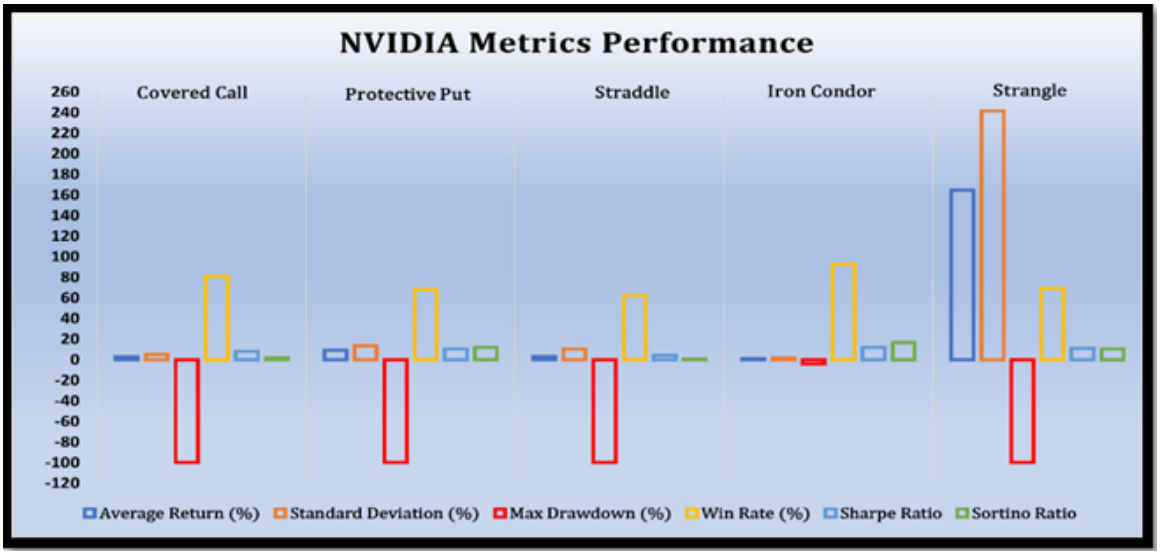
Figure 63. *AMD Metrics Performance*



NVIDIA Performance Metrics Analysis

Considering the five strategies Strangle, Iron Condor, Protective Put, Covered Call, and Straddle NVIDIA is the best company for strategic options trading considering it is more accurate over AMD on a risk- adjusted basis. Through constant returns (1.27%), extremely low volatility (1.69%), and a very satisfactory 93% win rate, the Iron Condor is consistently the most reliable and effective strategy. It is further supported by excellent Sortino (16.83) and Sharpe (11.86) ratios.

Figure 64. *NVIDIA Metrics Performance*



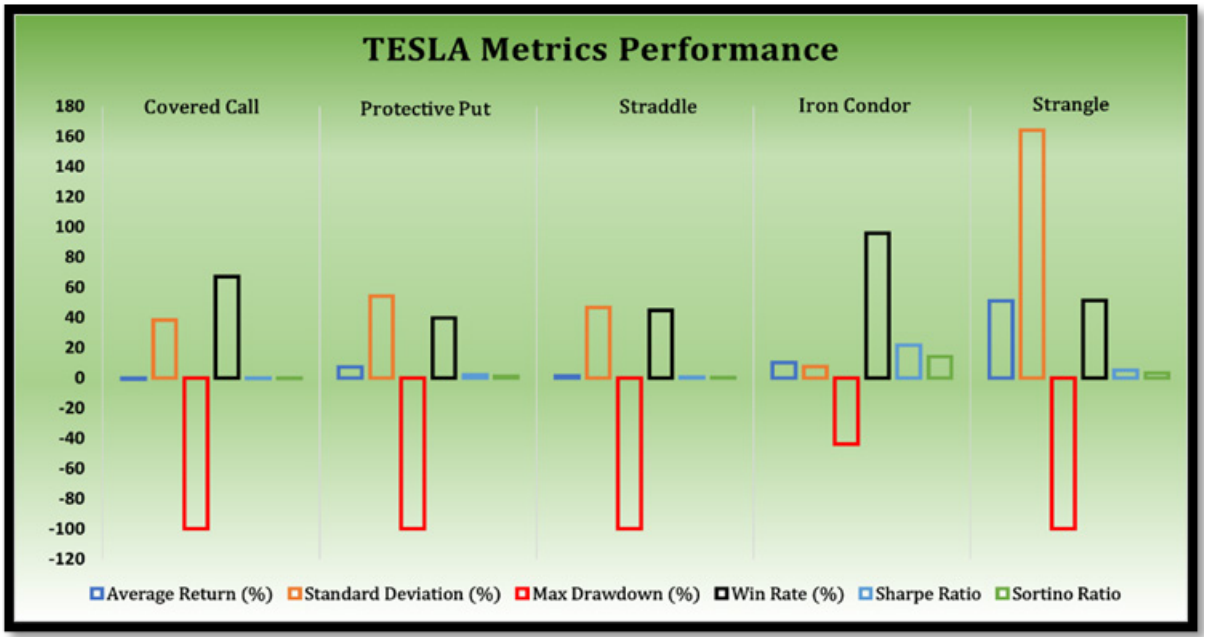
The Protective Put is an effective choice for conservative investors because it offers strong downside protection, risk-adjusted performance, along with substantial returns (9.16%) with modest risk. Although it is exposed during steep stock drops, the covered call generates steady income (2.64%) through low volatility and great dependability. The Strangle is a highly risky unpredictable strategy for traders who trade speculation considering its high volatility (241.7%) and complete drawdowns, despite its exceptionally high returns (164.45%). For steady market conditions, the Straddle continues to be the least desirable option due to its poor returns (2.95%) and negative risk efficiency.

TESLA Performance Metrics Analysis

In the context of risk-return results, Tesla's option strategies' return performance fluctuates greatly throughout the five techniques. With a 10.18% average return, low volatility (7.47%), a 95.85% win rate, and the highest Sharpe (21.62) and Sortino (14.17) proportions, the Iron Condor strategy is the most successful and reliable. This is in line with its exceptionally good synthesis of stability, efficiency, and profitability. The Strangle generated the most lucrative unadjusted return (50.96%), yet although extremely risk-tolerant, speculative traders should take it into consideration considering its tremendous volatility (164.15%) and –100% drawdown, combined expose it to extreme downside risk. Though it offered significant protection on the downside, the Protective Put's –100% drawdown and low risk-adjusted ratios demonstrate effectiveness in comparison to the Iron Condor, despite its inadequate returns (7.21%).

With low returns (1.14%) and poor risk-adjusted performance, the Straddle underperformed, indicating a limited prospective to profit from Tesla's volatile price movement. Furthermore, the Covered Call exhibited uncontrollable volatility (38.21%) and negative returns (–1.01%), demonstrating the possibility price increases were insufficient to offset the underlying market instability of Tesla.

Figure 64. *TESLA Metrics Performance*



5. Conclusion and Discussion

From the result obtained during the analysis, we can conclude here the Iron Condor continually outperformed each of the other five option strategies, which were used in this study to analyse the best-performing strategies among Covered Call, Protective Put, Straddle, Iron Condor, and Strangle on the three companies selected AMD, NVIDIA, and Tesla for the period from the beginning in 2021 to 2024. immediately after the epidemic, it provided consistent returns, min-

imal risk, and substantial win rates for all three companies. For instance, you might say Tesla's Iron Condor exhibited exceptional stability and risk management with an average return of 10.18% and a 95.85% win rate. In spite of its range-bound nature, this strategy performed well in quiet or comparatively volatile markets, and AMD and NVIDIA also produced strong and reliable outcomes.

Specifically for NVIDIA, the Strangle strategy contributed to the highest single-trade gains; nevertheless, it was less dependable due to its high volatility, significant losses, and dependability on timing precisely. The Protective Put had lower average returns due to high option costs, but it performed well in erratic markets. Out of all the strategies that had been selected for investigation, the Straddle and Covered Call strategies did exceptionally poorly overall partly because of time decay and a lack of protection during fluctuations in the market.

In overall performance, the Iron Condor was the most efficient and well-balanced strategy over the chosen data period, providing steady income with controlled risk, whereas the Strangle was only beneficial for aggressive traders during significant market fluctuations.

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GEORGIAN PRACTICES IN ENERGY EFFICIENCY AND BUILDING AUTOMATION

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Abstract

Drawing on recent literature and empirical data, this article examines an issue of strategic importance for both science and practice: energy efficiency and building automation in Georgia.

The focus is on identifying which technological solutions are most relevant for different functional building types and which solutions are currently most widely adopted.

The article concludes that the development trajectory of modern buildings is closely tied to innovative technologies whose deployment is aimed not only at user comfort, but also at optimising energy use and strengthening safety mechanisms.

Keywords: *Energy efficiency; building automation; technological solutions; innovative technologies; energy management; smart technologies; intelligent buildings*

I. Introduction

Energy efficiency and energy management are among the most significant and topical priorities in the development of modern residential and commercial spaces. These two concepts are closely interlinked: when implemented correctly, they not only reduce energy consumption but also lower environmental impact and enable more efficient cost control.

Energy efficiency means achieving maximum results with minimal energy input. This can be realised at the technological level. For example, through LED lighting or thermal insulation, as well as at the system level, including overall building design, space planning, and material selection. An energy-efficient building reduces heat loss in winter and heat gain in summer, thereby easing the load on heating and cooling systems. Ultimately, this approach lowers both energy use and utility costs.

Energy management, by contrast, is a broader and more dynamic process that involves continuous monitoring, analysis, and optimisation of energy consumption. It is implemented both programmatically (via energy management systems) and through human engagement (energy audits and changes in consumption behaviour). Energy management typically integrates digital technologies, sensors, IoT devices, and smart algorithms, enabling real-time assessment of energy use and prompt corrective action.

In contemporary smart homes, energy management systems control heating, cooling, lighting, household appliances, and

other electrical devices. Such systems not only record device operation but also learn user behaviour and automatically regulate energy consumption to maintain maximum comfort with minimal expenditure. For example, lights automatically switch off or heating shifts to an economy mode when a room is unoccupied, producing immediate savings.

Energy management systems are often integrated with renewable energy sources, such as solar panels or heat pumps, and can store, redistribute, and even feed surplus energy back to the grid. Through this integration, buildings become energy-active units, which is especially important in the context of sustainable development.

Energy efficiency and energy management help buildings meet standards such as Nearly Zero-Energy Building (nZEB) and Passive House, both of which aim for minimal energy consumption and reduced environmental impact. With these approaches, buildings are no longer merely energy consumers; they increasingly act as active managers and, at times, producers of energy.

To analyse these issues in practice, a study was conducted in three major cities of Georgia -Tbilisi, Batumi, and Kutaisi. The objective was to determine which specific solutions are most in demand in different building segments. The study relied on individual interviews and on-site review of existing systems.

II. Results and Discussion

The analysis of existing energy-efficient and automated buildings highlights a transformative process underway in recent years across urban and industrial architecture, both in Georgia and globally. A clear trend emerges: the development trajectory of modern buildings is inseparable from innovative technologies aimed not only at comfort but also at optimising energy performance and enhancing safety mechanisms.

The goal was not merely to map the popularity of specific technologies but to analyse their functional distribution by building type. Accordingly, a detailed methodology was designed to observe a broad spectrum of facilities, from residential apartments to GDP-standard pharmaceutical buildings. The findings show that, despite an overarching trend toward automation, concrete solutions are adopted at different speeds and for different purposes across building types (Table 1).

Table 1. *Functional distribution of specific technologies by building type*

Building Type	Lighting Automation	Heating/ Cooling (HVAC)	Door/ Entry Control	Motion Sensors	Thermostats	Gas/ Water Sensors	Security Cameras
1. Apartments (Residential)	H (H - High priority)	H	M (M– Medium priority)	H	H	M	M
2. Detached Houses	H	H	H	H	H	H	H
3. Hotels	H	H	M	H	H	M	H
4. Industrial Facilities	M	H	M	M	H	H	H
5. Office Buildings	H	H	M	H	H	L (L– Low priority)	M
6. Warehouses	M	M	L	H	M	M	M
7. GDP-Standard Pharmaceutical Buildings	H	H	H	H	H	H	H

The functional distribution of specific technologies by building type is as follows:

1. Apartments (Residential): Lighting and ventilation/thermal regulation are typical priorities, supported by motion sensors for comfort. Door automation and security cameras are of medium importance; they are frequently used, but continuous control is not always required.
2. Detached Houses: A maximally automated environment where all components tend to be prioritised, including security cameras and convenient access (entry automation), alongside widespread use of thermostats and sensors.
3. Hotels: Similar to residential apartments, but with increased emphasis on guest safety (security systems) and on heating/cooling.
4. Industrial Facilities: Cameras, thermal control, and safety-related sensors (e.g. gas and fire detectors) are key. Lighting and motion sensors are selectively deployed, particularly for nighttime operations.
5. Office Buildings: Lighting and HVAC automation are widely implemented to save energy. Solutions are designed to manage building operations efficiently during off-hours as well as working hours.
6. Warehouses: Motion detection and security are the primary needs. Other components are generally lower priority.
7. GDP-Standard Pharmaceutical Buildings: These are among the most demanding environments, requiring high-level control across virtually all domains: lighting, access, safety, heating/cooling, and tightly regulated conditions for gas, water, temperature, and humidity.

Across building classes, lighting automation and HVAC control play central roles. Because these subsystems account for the bulk of energy consumption, their optimisation has an outsized impact. Lighting automation has become both an economic and environmental imperative, particularly in urban and commercial spaces. HVAC automation is tightly coupled to overall energy performance and, especially under zonal control and mechanical ventilation, forms the spine of system integration.

Adoption patterns are not uniform. Segments such as GDP-standard facilities and hotels exhibit high levels of technological integration, whereas logistics-oriented spaces like warehouses tend to deploy only critical elements (e.g., motion detection and security cameras), guided by economic rationale and functional specificity. Regulatory strictness, intended use, and operational characteristics also shape the pace and depth of adoption.

Importantly, the effectiveness of smart systems increases markedly when they operate as an integrated whole. For example, via Building Management Systems (BMS), IoT, and PLC/SCADA platforms using protocols such as KNX and Zigbee. Buildings that centralise control of voice assistants, sensors, lighting, and thermostats demonstrate clear gains in energy efficiency and user comfort, which in turn enhance asset performance, value, and service quality.

III. Conclusion

Energy efficiency and building automation practices in Georgia are developing incrementally. The level of adoption depends directly on a building's functional purpose as well as the owner's vision and investment readiness. To achieve comprehensive and long-term benefits, a systemic approach is essential, one that goes beyond selecting technical solutions to embrace user-centric, flexible, and multifunctional architectures. This direction has emerged as a core strategic priority at the intersection of sustainable urban development, energy-economic optimisation, and environmental responsibility.

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TRANSPARENT FISCAL SUSTAINABILITY: INTEGRATING GOVERNANCE INTEGRITY INTO GREEN ECONOMIC REFORM

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Abstract

Fiscal systems shape not only budgets but also public confidence. This article presents the Transparent Fiscal Sustainability (TFS) framework – a three-pillar model linking ethics, oversight, and participation to credible green budgeting. Governments that disclose data, verify results, and invite citizens into decision-making tend to manage debt and climate commitments more effectively. Drawing on recent IMF, OECD, and ADB materials, the paper outlines measurable indicators and small, practical tools that embed integrity in fiscal operations. In short, transparency keeps policy believable and reform sustainable.

Keywords: *fiscal sustainability; integrity; transparency; green reform; accountability; governance*

Introduction

Every national budget now carries an environmental story. Whether it is a line for renewable energy or a new tax on emissions, fiscal choices define how seriously a government treats sustainability. Yet public attention moves quickly; promises fade if numbers are hard to trace. In 2023, for example, Malaysia's Treasury posted its first climate-budget table – simple, but it drew more attention than any speech.

The idea behind Transparent Fiscal Sustainability (TFS) is that credibility grows from visibility. Fiscal ethics, once seen as an internal discipline, has become a form of infrastructure. During my review of regional practices, I noticed that systems working best share one trait: people can check them. Openness changes tone – it turns political claims into administrative habits.

Method

This study follows a comparative policy approach rather than formal econometrics. I reviewed IMF Fiscal Transparency Evaluations (2024), OECD integrity reports (2023), and Asian Development Bank notes on climate budgeting. Each source was coded for three variables: disclosure coverage, audit follow-up, and citizen-feedback access. I also compared a few national portals – Indonesia's

open-budget site, Thailand's green-bond tracker – to see what information appears first and what remains hidden.

Instead of testing hypotheses, I looked for patterns of behavior. When ministries publish project data early, trust rises even before new laws appear. That observation guided the design of the TFS framework.

Transparent Fiscal Sustainability Framework

The framework has three connected pillars that work as feedback loops.

1. Ethics and Transparency Visibility comes first. Governments should issue a Green Budget Statement listing all climate-related taxes and expenditures, and update data quarterly. Even rough spreadsheets help. People value timing over polish.
2. Oversight and Accountability Audit institutions need a clear climate mandate. Checking legality is not enough; reports must track whether green spending actually reduces risk. Integrity-risk maps and follow-up tables show if recommendations matter. As one auditor in Bangkok noted during a workshop, "numbers mean little if no one circles back."
3. Participation and Feedback Public participation turns budgets into dialogue. Digital consultations, short town-hall sessions, or comment boxes on finance ministry portals all count. The Global Initiative for Fiscal Transparency (GIFT) recommends recording not only how many people respond but how quickly the agency replies.

Table 1. *Transparent Fiscal Sustainability (TFS) Framework: Pillars and Indicators*

Pillar	Main Indicators	Purpose
Ethics & Transparency	Climate-budget disclosure ratio; update frequency	Reveal visibility of green spending
Oversight & Accountability	Audit-coverage rate; share of acted-upon findings	Measure institutional discipline
Participation & Feedback	Consultation count: average response time	Track engagement and responsiveness

Discussion

Applying TFS shifts fiscal management from paperwork to communication. Transparency converts environmental finance into something citizens can verify. Oversight gives those numbers weight. Participation keeps both accountable.

In practice, finance ministries can insert transparency metrics into budget circulars; audit offices can align review schedules with climate programs; civic groups can compare official data with field evidence. While examining these examples, I realized that most integrity gaps are procedural, not ideological – often a missing upload, not a missing law. Fixing them costs less than postponing them.

Conclusion

Sustainable finance depends on credibility more than complexity. Publishing numbers, checking outcomes, and inviting comment may sound routine, yet they are what give budgets moral weight. The Transparent Fiscal Sustainability framework distills that logic into three steps: disclose, verify, engage. Governments that follow this rhythm align fiscal responsibility with public ethics. And once transparency becomes a habit, not a headline, it quietly rebuilds trust.

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OBTAINING COMPLEX FERTILIZERS BASED ON GLAUCONITE, PHOSPHORITE, SAPROPEL OF KARAKALPAKSTAN IN THE PRESENCE OF UREA

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Abstract

The article shows possible ways of using the mineral glauconite, phosphorite, sapropel of Karakalpakstan and their role in the agricultural sector. The process of obtaining complex fertilizers based on glauconite, phosphorite and sapropel of Karakalpakstan with the addition of carbamide was investigated. The possibility of producing complex fertilisers based on raw materials with carbamide, which content of N_2 ranges from 9,2–9,6; K_2O 1,5–3,1; P_2O_5 3,51–8,3%, respectively. Diffractograms and EDR analysis of these minerals are also provided. The results of existing experience in the use of glauconite, phosphorite and saprolpel in agriculture show that these mineral raw materials have the property of restoring soil fertility due to the content of various trace elements that increase soil fertility. Along with this, the water-retaining property of these minerals will allow more rational use of water.

Keywords: *Karakalpakstan, Krantau, glauconite, Kushkanatau, sapropel, phosphorite, fertilizers, meliorant, trace elements, agriculture*

Introduction

Cotton, rice, wheat, maize produced and cultivated in Karakalpakstan noticeably respond to changes in the diet, the composition of nutrients contained in fertilizers of nitrogen, phosphorus, potassium and trace elements. Therefore, this time the most urgent task is to develop new methods for producing and using effective mineral fertilizers. In this regard, great attention is paid to the problem of the development and use in Uzbekistan and Karakalpakstan of mineral fertilizers obtained on the basis of local, natural raw materials, which include a highly dispersed variety of bentonite clays, glauconites, phosphorites, sapropel and others, which contain up to 15 different trace elements and organic matter. The use of glauconite sands, phosphorite flour and sapropel directly as fertilizer, or the preparation of complex microelements containing fertilizers on their basis, is of great economic importance for our region, since it leads to a decrease in the cost of mineral fertilizers by replacing some of the imported fertilizers with cheap, local fertilizers, which leads to a decrease in the cost of their use. The presence of large areas of glauconite containing sands of phosphorite deposits and sapropel in the territory of Karakalpakstan, their availability, dictate the need for their more detailed study and development of technology for obtaining complex fertilizers based on them (Artyushin A. M., Derzhavin L. M., 1984; Environmental problems of Uzbekistan. (2011); Allaniyazov D. O., 2019; Allaniyazov D. O., Erkaev A. U., 2021; Allaniyazov D. O., Erkayev A. U., Tajibayev T. A., Ochilov S. U., 2023).

Carbamide is the main source of nitrogen as a fertilizer and, in combination with phosphorus and potassium, enhances the synergistic effect of nutrients needed for plants in the soil. The combined use of carbamide and phosphorite leads to a decrease in the pH level, which increases the rate of absorption of phosphorus in the form of P_2O_5 (phosphorus oxide) and improves its solubility in water.

Research objects and methods

The object of research in this work is the glauconite sands of Krantau, phosphorite flour, sapropel of the Kushkanatau field of Karakalpakstan and standard mineral fertilizers produced from plants of Uzbekistan urea.

Research material and methodology

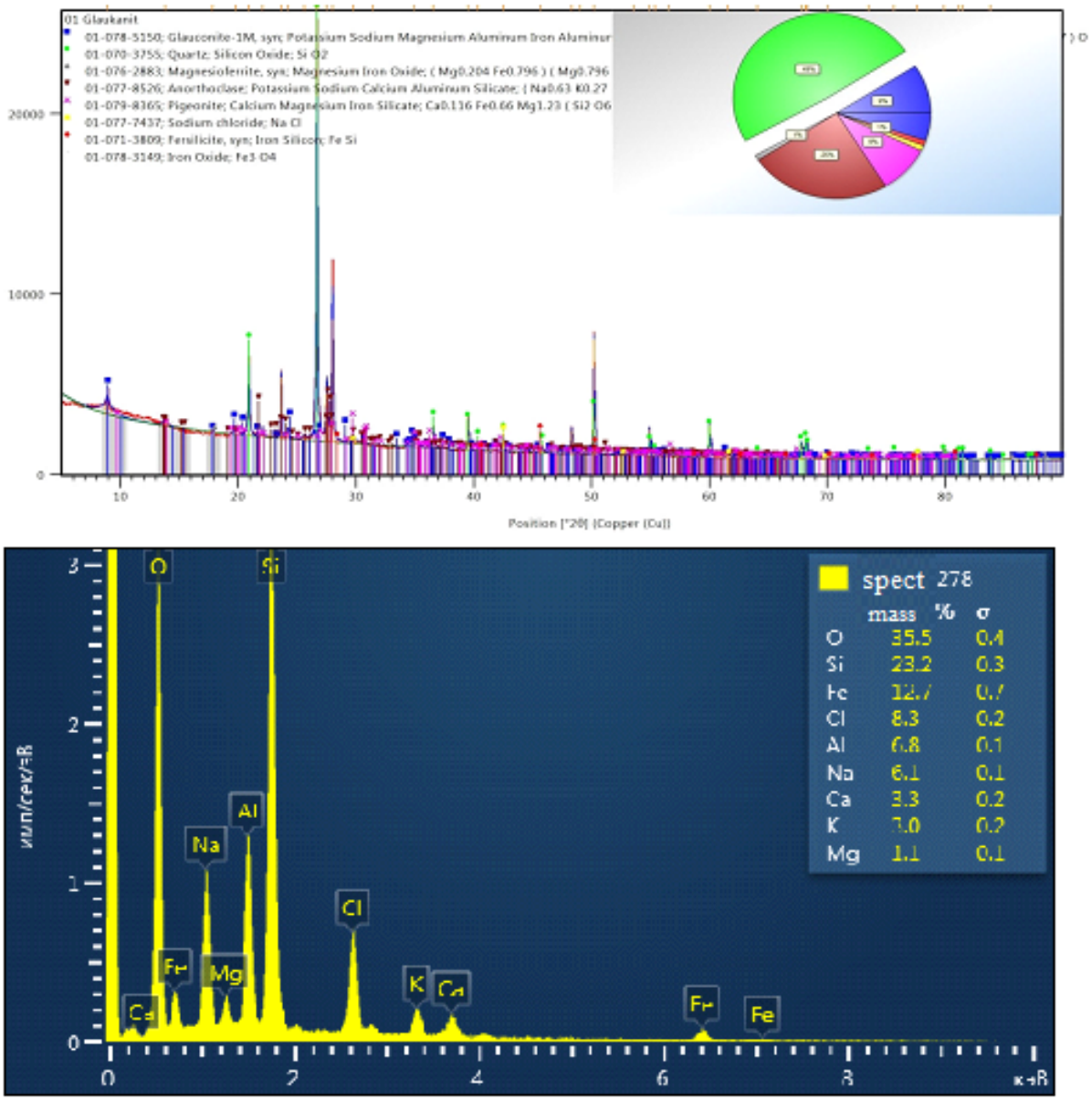
The samples were identified on the basis of diffractograms taken on a computer-controlled XRD-6100 apparatus (Shimadzu, Japan). Radiation-CuKa (β-filter, Ni, 1,54178 current and tube voltage mode 30 mA, kV) and a constant detector speed of 4 degrees per minute, in increments of 0.02 degrees, (ω/20 adhesion) were used, and the scanning angle varied from 4 to 800. The scanning angle in diffractometric studies varied from 2 to 80°. Qualitative and quantitative identification of the phases of the presented samples was carried out using the MATCH! ® Phase identification from Powder Diffraction program (Crystal Impact, GbR, Bonn, Germany, 2015) (MATCH!® 2015; Döbelin, N., Kleeberg, R., 2015). In laboratory conditions, the effect of carbamide on the process of producing complex fertilizers from components of the sapropel, phosphorite, and glauconite system was studied.

Research results:

The production of complex mineral fertilizers based on glauconite, phosphorite and sapropel continued to be widely used in agriculture. Figure 1–3 shows diffractograms and EDS analysis of glauconite sands, phosphorites and sapropel. When taking diffractograms, the same modes were observed, and sample weights were approximately equal.

The following chemical elements were recorded in the energy dispersion spectrum of these raw materials with the following percentage correspondences; (Glauconite) oxygen 35,5; silicon 23,2; iron 12,7; chlorine 8,3; aluminium 6,8; sodium 6,1; calcium 3,3; potassium 3,0; magnesium 1,1. (Phosphorite) oxygen 39,0; calcium 36,2; phosphorus 6,7; carbon 6,2; silicon 4,6; sulphur 2,5; fluorine 1,8; aluminium 1,4; sodium 0,8; magnesium 0,8. (Sapropel) oxygen 45,2; silicon 24,2; aluminium 9,0; iron 7,6; calcium 6,4; potassium 3,5; magnesium 2,1; sodium 1,1 and chlorine 0,8. Processing these materials has the potential to increase agricultural yields.

Figure 1. *Diffractogram EDR Analysis of Glauconite in the Krantau Field*



The results show that as the carbamide content of the mixture increases, the strength of the formed granules also increases. If the standard strength of carbamide granules is 1,5 MPa, then when the ratio of mixture to carbamide changes from (100:0) to (63:37), this indicator increases from 0,68 to 3,6 MPa. The maximum pellet strength – 4,15 MPa – is achieved with a mixture to carbamide ratio of 50:50. In addition, as the urea content of the fertilizer increases, the digestibility of P_2O_5 plants improves. The highest digestibility of phosphorus was observed at the ratios of the mixture to carbamide (80:20) and (63:37). It can also be noted that as the carbamide content in the mixture increases, the amount of nutrients increases. At a mixture to carbamide ratio of (100:0), the N, P_2O_5 and K_2O content was 7%, while the maximum nutrient content was observed at ratios of (50:50) and (63:37). The relative composition of sapropel, phosphorite and glauconite components was compiled using ternar diagrams. The results are shown in (Fig. 4).

Figure 2. *Diffractogram and EDR analysis of phosphorite of the Central Kyzylkum*

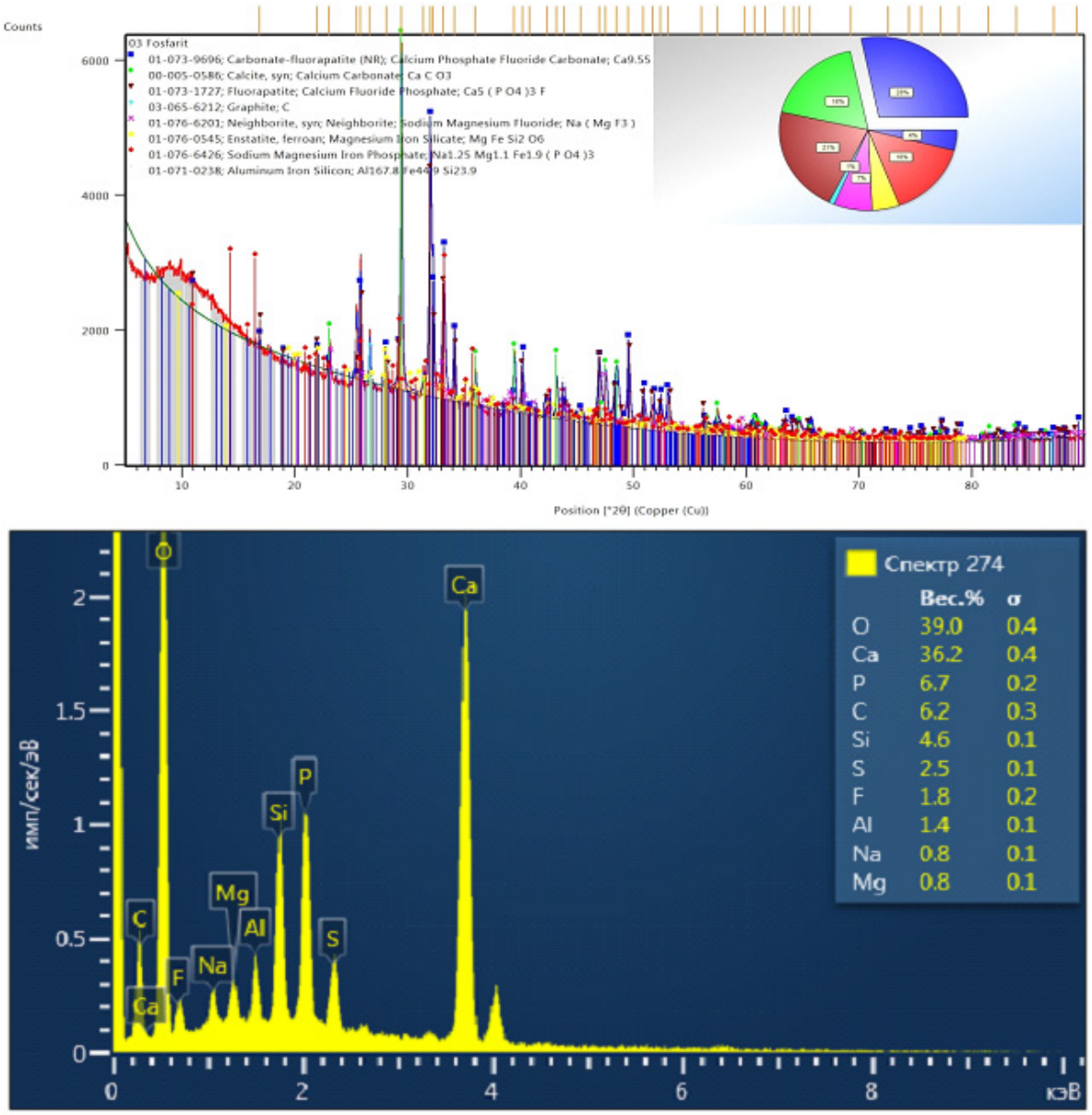
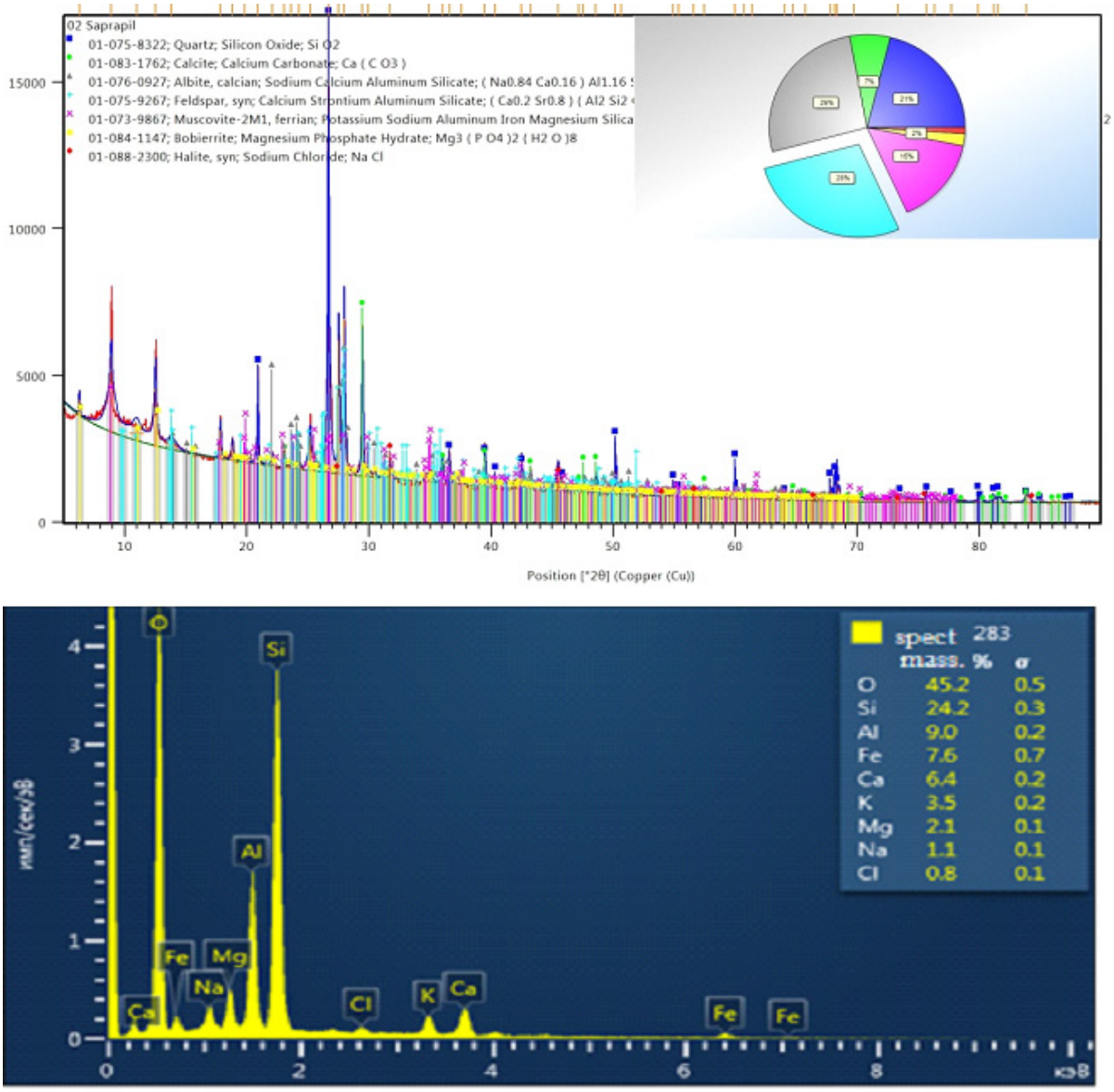


Figure 3. *Diffractogram of EDR analysis of sapropel in the Kushkanatau field*



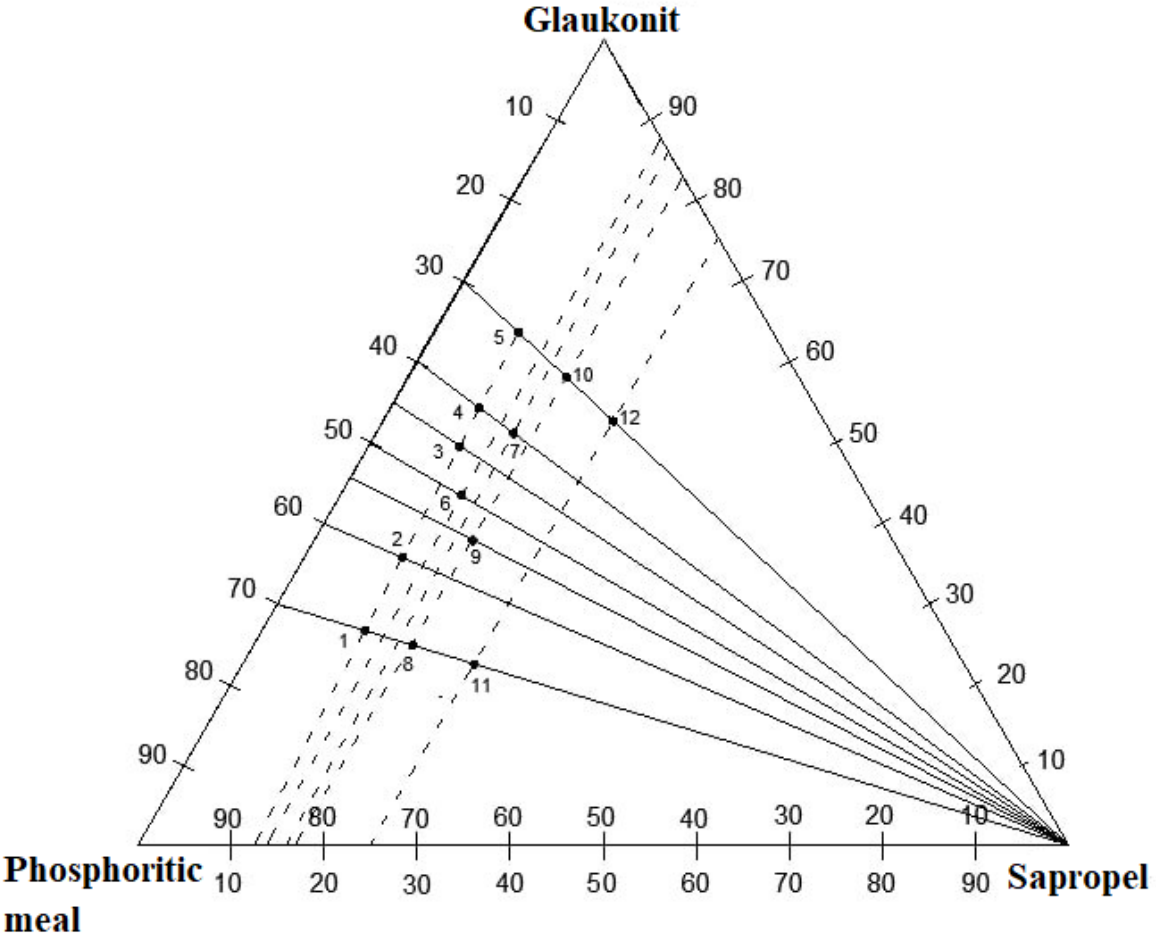
Laboratory tests were performed based on the selected ratios. From the obtained research results, mixtures were prepared in ratios of 5:10:12, and studies with the addition of carbamide in ratios of 100:0, 80:20, 63:37, 50:50 were continued. First of all, sapropel, phosphorite, glauconite and carbamide were crushed to the same particle size, thoroughly mixed to a homogeneous mass and granulated in a plate granulator. A 10% ammonium sulfate solution was used as the coupling reagent.

As a result, granules containing organic groups and trace elements were obtained, the appearance of which was similar to standard fertilizer granules produced in factories. The obtained products were analyzed for the content of N, P_2O_5, K_2O, CaO, Mg according to conventional methods. The strength of the pellets was also measured. The results are shown in Table 2.

The sum of the nutrient components, depending on the ratio of Glauconite+Fosmuca+Sapropel, varies within; 16,3–33,5; 16,11–31,5% and 16,2–31,5% with carbamide, respectively.

Further, the elemental composition of the resulting meliorants was studied. From (Fig. 5) it can be seen that the composition of meliorants contains the highest content of elements O_2, Ca, C, Si, N_2, K, P, Al, Fe, etc.

Figure 4. *Relative content of sapropel, phosphorite and glauconite components (triangular diagram)*



Based on the ternar diagram (Fig. 4), the material and granulometric composition of the meliorant is determined. The results are shown in Table 1.

Table 1. *Material and particle size distribution of meliorant*

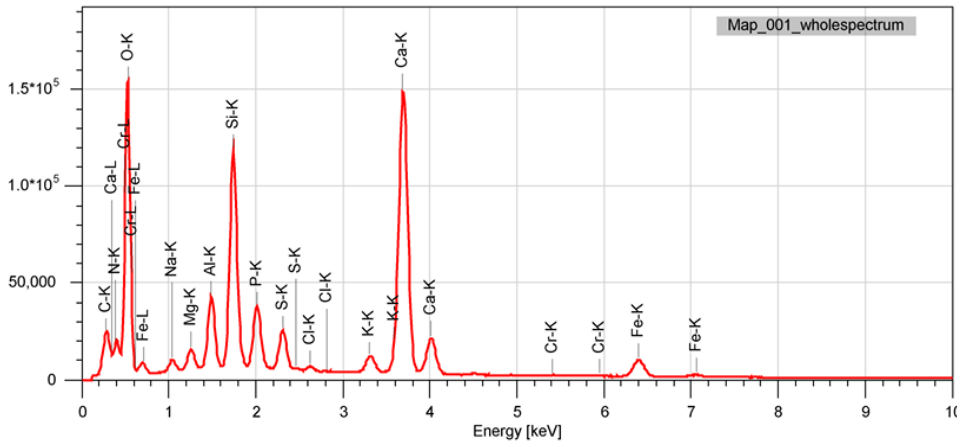
Sample numbers correspond to nomogram numbers, (Fig. 1)	Material composition, gr					Particle size distribution of meliorant grain-size mass, %				
	Enriched glauconite	Fosmuka C.K.	Sapropel	Carbamide	$(NH_4)_2SO_4$ 10%	4	-4+3	-3+2	-2+1	0–001
1.	19.6	50.4	10	20	8	3	25	54	9	9
2.	48.4	21.6	10	20	11	4	23	52	12	9
3.	19	46	15	20	14	6	24.2	49.8	14	6
4.	45.4	19.6	15	20	9	6	30	51	10.5	2.5
5.	18	42	20	20	14	5.4	25	57	8.6	4
6.	39.8	20.2	20	20	11	3	30	59	13	5

From table 1 it can be seen that the main granulometric mass of the fraction content is –4+3; 23,0–30,0 and –3+2 are 49,8–59%, respectively

Table 2. *Chemical composition of meliorant treated with carbamide*

Sample numbers correspond to (Table 1)	Content of components,%									Sum of nutrients,%		Pellet strength MPa
	N %	K_2O %	P_2O_5 total.%	CaO	S	P_2O_5 digestible 2%-each – citric acid %	P_2O_5 water, %	$\frac{P_2O_5 \text{digestible}}{P_2O_5 \text{total}}$ · 2%–each –citric acid, %	$\frac{P_2O_5 \text{water}}{P_2O_5 \text{total}}$ %	$N+P_2O_5+K_2O$, %	$N+P_2O_5+K_2O+S+CaO+MgO$ %	
1.	9.4	1.5	8.3	22.5	4.65	3.73	1.91	45.0	23.0	19.2	48	3.5
2.	9.2	3.05	4.01	14.68	2.4	3.2	2.41	80	61	16.3	33.5	2.6
3.	9.5	1.66	7.4	23.3	4.3	4.66	2.1	63.0	28.4	18.54	47.65	3.5
4.	9.5	3.1	3.51	10.8	2.12	2.73	1.37	78	39.2	16.11	31.5	2.9
5.	9.6	1.82	6.95	21.5	3.9	4.2	1.89	60.4	27.2	18.32	45.54	3.5
6.	9.6	3.02	3.55	12.9	1.9	3.1	2.21	87.5	62.3	16.2	31.5	3.3

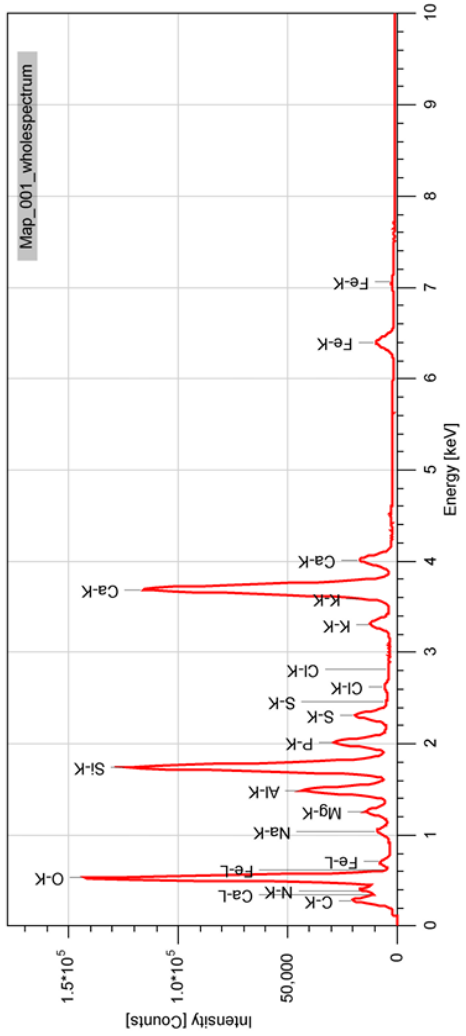
Figure 5. *Elemental analysis results for meliorant, table 1–2, sample-2,4,6, treated with carbamide.* **Sample 2.**



Element	Line	Mass%	Atom%
C	K	11.70±0.02	18.52±0.03
N	K	7.74±0.03	10.51±0.04
O	K	41.72±0.05	49.58±0.05
Na	K	0.71±0.01	0.58±0.00
Mg	K	0.84±0.00	0.66±0.00
Al	K	2.60±0.01	1.83±0.01
Si	K	7.51±0.01	5.08±0.01
P	K	3.24±0.01	1.99±0.00
S	K	1.94±0.01	1.15±0.00
Cl	K	0.26±0.00	0.14±0.00
K	K	0.98±0.00	0.47±0.00
Ca	K	18.07±0.02	8.57±0.01
Cr	K	0.08±0.00	0.03±0.00
Fe	K	2.63±0.01	0.89±0.00
Total		100.00	100.00

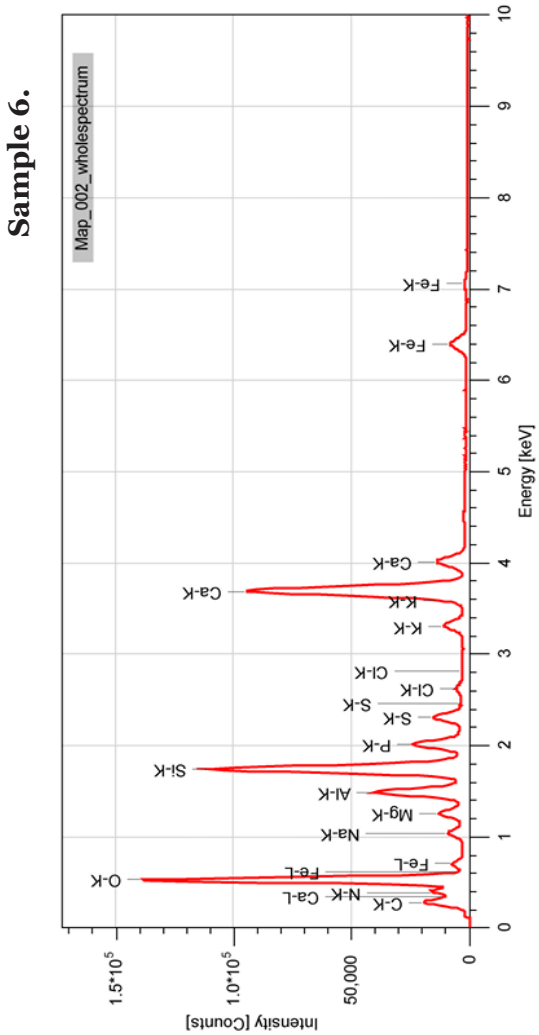
Sample 4.

Element	Line	Mass%	Atom%	
C	K	11.70±0.02		18.56±0.03
N	K	5.73±0.03		7.79±0.04
O	K	43.34±0.05		51.61±0.06
Na	K	0.74±0.01		0.62±0.01
Mg	K	0.89±0.01		0.70±0.00
Al	K	3.12±0.01		2.21±0.01
Si	K	9.23±0.01		6.26±0.01
P	K	2.89±0.01		1.78±0.00
S	K	1.66±0.01		0.99±0.00
Cl	K	0.23±0.00		0.12±0.00
K	K	1.19±0.01		0.58±0.00
Ca	K	16.45±0.02		7.82±0.01
Fe	K	2.83±0.01		0.97±0.00
Total		100.00	100.00	



Sample 6.

Element	Line	Mass%	Atom%	
C	K	12.20±0.02		19.04±0.03
N	K	5.85±0.03		7.84±0.04
O	K	44.63±0.05		52.30±0.06
Na	K	0.86±0.01		0.70±0.01
Mg	K	0.91±0.01		0.70±0.00
Al	K	3.26±0.01		2.26±0.01
Si	K	9.20±0.01		6.14±0.01
P	K	2.67±0.01		1.62±0.00
S	K	1.46±0.01		0.86±0.00
Cl	K	0.32±0.00		0.17±0.00
K	K	1.15±0.01		0.55±0.00
Ca	K	14.77±0.02		6.91±0.01
Fe	K	2.71±0.01		0.91±0.00
Total		100.00	100.00	



Conclusions

The interaction of the components: glauconite, phosphorite, sapropel and carbamide was studied, while their elemental composition was determined using modern physicochemical methods of analysis.

The process of obtaining complex fertilizers based on mineral raw materials of Karakalpakstan was studied. The sum of the nutrient components, depending on the ratio of Glauconite+Fosmuca+Sapropel, varies within; 16,3–33,5; 16,11–31,5% and 16,2–31,5% with carbamide, respectively. Urea remains neutral in these fertilizers. When making complex fertilizers, these interactions should be taken into account.

It has been determined that in complex fertilizers, the introduced components may be crystalline or amorphous due to interaction with water, glauconite and other components.

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SOME PERSPECTIVES IN HISTORIOGRAPHY ON THE EXISTENCE OF KIPCHAK STATEHOOD

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Abstract

The study presents a brief analysis of historiography devoted to the topic of the statehood of the Kipchaks, whom European peoples called Cumans or Comans, and Russians called Polovtsians. The approaches of some Western, Russian-Soviet and Kazakh scientists on the presence and nature of the Kipchak statehood are briefly described. The well-known American Turkologist Peter Golden, who accepted the Kimek Khanate (Kimek Confederation) as a form of nomadic statehood, adheres to the opinion about the absence of statehood in relation to the Kipchaks. He considered the Kipchak khans to be leaders and their state formations to be simply a confederation of tribes.

Most Russian-Soviet historians such as S. A. Pletneva, G. A. Fedorov-Davydov, Z. M. Sharapova and others defended the opinion that the economy, social structure and culture of the Kipchaks had not matured to the level of an early feudal state. Some of them, influenced by the works of V. V. Bartold, believe that the Kipchaks did not have a single state. However, their various ethnopolitical and territorial associations reached the level of state formations – Khanates.

The attitude of Kazakh scientists to this problem differs significantly from others. Orientalist B. E. Kumekov considers the Kipchaks to be the heirs of the traditions of the Kimek statehood. He is also supported by N. E. Kuzembayev, A. Sh. Kadyrbayev and others. Kazakh scientist S. M. Akhinzhanov has his own view to the problem. He adheres to the opinion of the absence of a single state of the Kipchaks. However, the scientist considers separate ethno-territorial associations – Eastern Desht-i Kipchak and Western Desht-i Kipchak to have reached the level of an early fedal state.

Keywords: *early feudal state, Kazakh scientists, Kipchak Khanate, military-nomadic form of statehood*

Introduction

The ethnopolitical map of Central Asia began to change significantly at the turn of the 10th–11th centuries, which was largely due to the events taking place in the Kimek Khanate, which led to the collapse of this state

entity. According to researchers, the centrifugal aspirations of the Kipchaks played the decisive role, *striving for self-determination and the creation of their own statehood* (Kumekov B. E., 1996, p. 326–327; Kumekov B. E., 2023, 300). It is also noted that as a result of these turbulent events, the Kimeks themselves, who created a *nomadic and semi-nomadic state with their own ethnopolitonym* (Alymkulova S. K., Choroev T. K., Butanaev V. Y., 2023, 302) ceded political hegemony to the Kipchaks (Kumekov B. E., 2023, 300).

The territory of Desht-i-Kipchak is conventionally divided (along the Ural /Yaik River) into two parts – to the east of the Ural River – *the eastern (Central Asian) branch*, covering *the real Kipchaks (the so-called Kangly in the Mongolian period)* and *to the west of the Urals, the western (Danube-Ponto-Caspian or East European) branch of the Cumans-Polovtsians* (Stoyanov Valery. 2021, 362). At the same time, there was no unified administrative and political system in *Desht-i-Kipchak*. The largest Kipchak groupings were located in the region of the Dnieper, Dniester, Ural and lower Volga; such confederations or hordes were most often called by the ancient Turkic term *il*, while ethnoterritorial groupings were known as *ulus*. There were several groupings in *Desht-i-Kipchak*, headed by khans (Agajanov S. G., 1998, 79).

It is believed that at first, after settling in the southern Russian steppes, the Kipchaks were mainly concentrated in two large hordes (Knyazky I. O., 1996, 53). The Western Dnieper union is the possessions of the Bonyakids (from the lower sides of the Dnieper to the Danube) (Rybakov B. A., 1952, 44; Papaskiri Z. V., 1982. 86; Dzhichonaia I. R., 2012, 82). As it turns out, B. A. Rybakov mistakenly identified at one time with the *White Cumania* of the 12th century Arab geographer, al-Idrisi, as well as the eastern Don union – "the unknown land", the possessions of Sharukan the Old (Volga, Pomorie, Surozh, Corsun, Tmutarakan, Great Don /Northern Donets) (Rybakov B. A., 1952, 44; Papaskiri Z. V., 1982, 86; Dzhichonaia I. R., 2012, 82) – with the *Black Cumania* of the same author (In fact, as I. G. Konovalova, a recognized authority in the field of source studies and the history of medieval Islamic geography and cartography, has convincingly shown, in the work of the eminent Arab geographer, *"Black Cumania"* and *"White Cumania"* are only the names of Polovtsian cities (settlements), and not individual regions (large nomadic camps) of the entire Polovtsian land. According to I. G. Konovalova, "White Cumania" is Tmutarakan) (Konovalova I. G., 2006, p. 219–221; Konovalova I. G., 1992, p. 31–34).

Approaches on the issue of statehood among the Kipchaks in historiography

One of the most discussed topics in scientific Kipchak studies is the question of the existence of statehood among the Kipchaks. The first scientist who expressed his authoritative opinion on this issue was Academician V. V. Bartold, pointing out that *there were separate... khans, but there was never a khan of all Kipchaks* (Bartold V. V., 1968, 99; Kuzembaev. N. E., 2013, 91), in fact, denied the existence of Kipchak statehood (According to some researchers, the above statement by V. V. Bartold does not at all mean that the venerable scholar questioned "the fact of the existence of statehood among the Kipchak tribes **in general**," and that in this passage the author (i.e. V. V. Bartold) spoke only about the absence of **a single** state among the Kipchaks) (Kuzembaev. N. E., 2013, 91) (In support of this interpretation, V. V. Bartold's judgment is given regarding the conditions for the formation of the state, according to which: *"one of the extraordinary circumstances under the influence of which the state was created could be the aggravation of the class struggle between the rich and the poor, between the beks and the common people. In a nomadic society, differences in property and class already reach such limits that such an exacerbation is entirely possible")* (Kuzembaev. N. E., 2013, 91; Bartold V. V., 1968, 23).

D. A. Rasovsky offered interesting observations on the issue of the Kipchak statehood. According to the scholar, the Kipchaks, unlike their Seljuk and Ottoman brethren (who *being nomads, left their steppes, made their way to countries with a settled population, conquered these countries and created a new statehood there, first semi-nomadic, then turning into a purely settled one*), nev-

er *created any state* (Rasovsky D. A., 2012, 198). As one of the arguments for this conclusion, D. A. Rasovsky also cites the fact that the Kipchaks, even when they *entered the capital... of Russia, Kyiv..., never tried to take advantage of their dominant position and did not try to create their own, new, statehood here* (Rasovsky D. A., 2012, 198).

The prominent orientalist A. U. Yakubovsky also did not see a single state structure in *Desht-i-Kipchak* and spoke only *about the existence here* (at the beginning of the 13th century – on the eve of the Mongol-Tatar invasion) *of several nomadic principalities* (Yakubovsky. 1950; Grekov B. D., Yakubovsky A. Yu., 1950, 18). A. I. Popov (Popov A. I., 1949, 99; Kuzembaev. N. E., 2013, 91) and Z. M. Sharapova (Sharapova Z. M., 1953, 131; Kuzembaev. N. E., 2013, 91) reasoned similarly. G. A. Fedorov-Davydov, another authoritative specialist in the nomadic world, believed that these were only separate *unions of tribes*. In addition, he stated, *This unions of tribes never covered the entire Polovtsian population in the history of pre-Mongol Polovtsian steppe*. Even *the powerful khans Bonyak and Tugorkan had power mainly over the western Polovtsian lands* and their contemporary *Khan Sharukan ruled in the Donetsk steppes*. His descendant, Khan Konchak, went further than others, who *possibly... managed to create a relatively strong unification of part of the Polovtsians within the framework of the nomadic state and transfer power over this unification into the hands of his son Yuri. But Konchak's state had neither a governing apparatus nor a tax system and was... only the embryo of a state* (Fedorov-Davydov G. A., 1966, p. 147–150; Kuzembaev. N. E., 2013, 91).

The era of Konchak-Yuri was also clarified by S. A. Pletneva. According to her observations, *not a single steppe association, apparently, could compare with Konchak's domain. However, despite its strength and wealth, its significant territorial size... the emergence of a ruling class of feudal lords* (In another place of her fundamental study, S. A. Pletneva speaks of the rapid transition of the Kipchaks *"to a class society," which was facilitated by "communication with developed feudal states that surrounded the Polovtsian steppe... from all sides" From the second half of the 12th century, "in the steppes, it was no longer amorphous tribal associations that roamed,... but hordes headed by feudal lords, which united strong cells – ails (koshi)."*) (Pletneva S. A., 1990, 145) *with a fairly well-developed hierarchy in the Polovtsian environment, despite even such an effective factor as a strong central authority, Konchak's association did not become a state* (Pletneva S. A., 1990, 168). She considered the main reason for this situation to be the absence of the necessary prerequisites for the formation of a state, primarily an economic base, which continued to remain *nomadic-pastoral,* while for the formation of a state, a mandatory condition, according to S. A. Pletneva, is the merger of *two economic systems: agricultural and pastoral* (Pletneva S. A., 1990, 168). This economic background, as well as the presence of *strong vestiges of the tribal system in social relations (the patriarchal veil)* remained an obstacle to the formation of state structures. That is why *there was no need to create an army or courts (the khan himself judged according to customary law); a single monotheistic religion was not accepted, although the movement towards its acceptance had already begun* (At the same time, S. A. Pletneva notes that the proximity and constant contacts with Christian (Byzantium, Russia, Bulgaria, Georgia, Hungary) and Muslim countries could naturally contribute to the penetration of *"these two religions into the nomadic steppes";* Pletneva S. A. Polovtsians.., 1990, p. 143; According to the conclusion of the famous American Kipchak scholar, P. Golden, who has specially studied the religion of the Kipchaks, *"despite the fact that the Kipchaks had reached the state of a complex,* ***stateless form of political organization, the impulses to adopt a monotheistic faith****, which could possibly have helped strengthen the ideological arguments of the leaders and their "governments" striving for centralized power,* ***were very weakly expressed****";* Golden P., 2008, 309). *The Polovtsians did not master writing either. Thus, neither the economy, nor the social structure, nor the culture were yet ripe for the creation of even an early feudal state* Polovtsy (Pletneva S. A., 1990, 168). Despite the fact that in her early works, S. A. Pletneva considered it possible *to assert*

that the Don union of Polovtsians, which was already under the hereditary power of Yuri Konchakovich, which passed from father to son (and not... from uncle to nephew), had already begun to take shape by 1224 ***as an early feudal nomadic state****, similar to the Khazar Khaganate of the 8th century. It is possible that the Dnieper Polovtsians also joined this union* (Pletneva S. A., 1975, 300).

This thesis was fully shared by S. M. Akhinzhanov (Akhinzhanov S. M., 1995, 145), although, having generalized all the sources regarding the Kipchak society as a whole, the Kazakh researcher came to the conclusion that it *in pre-Mongol times was only at the stage of state formation, the peculiarity of which was the presence of a large number of remnants of tribal relations in all spheres* (Akhinzhanov S. M., 1995, 290). And other Kazakh scholars seem to be inclined to believe that the Kipchaks did have their own statehood. Thus, according to academician B. E. Kumekov, *the Kipchaks became the successors of the Kimek statehood* (Kumekov B. E., 1996, 327; Kumekov B. E., 2023, 300). N. E. Kuzembaev partially agrees with him, who also emphasizes the influence of *ancient Turkic and Kimek state traditions* and believes that, being the heirs of these traditions, the Kipchaks actually *possessed the necessary potential to create their own state*. However, the scientist, showing some caution, refrains ***from recognizing a single state*** or ***separate state entities*** among them. A number of unresolved problems are considered to be obstacles on this path, first of all, *problems of the specifics of nomadic society, ethnic composition, administrative-political structure and social organization, customary law, taxation, writing* (Kuzembaev. N. E., 2013, 95). We find a similar conclusion in a recent publication with co-authors such as S. K. Alymkulova, T. K. Choroev and V. Y. Butanaev, which notes that *due to their habitation in the most remote parts of the steppe of Eurasia, the Kipchaks did not create any single Khanate for the entire steppe* (Alymkulova S. K., Choroev T. K., Butanaev V. Y., 2023, 303).

Unlike Kazakh scholars, their colleagues from Russia and other countries are more categorical, denying the existence of statehood among the Kipchaks. For example, according to Y. A. Yevstigneyev, *the leadership of the Kipchaks in Desht-i Kipchak did not mean that they created their own state* (Evstigneev Y. A., 2012, 98). In another publication, the same author quite clearly writes that the country called *Desht-i Kipchak, the Kipchak Steppe* (contrary to the opinion of some Kazakh scholars) (Kumekov B. E., 1995, 71) *has never been a state* (Kumekov B. E., 1995, 71). I. O. Knyazky holds the same view, according to which the Kipchaks did not have a state (Kumekov B. E., 1995, 71).

This thesis is most actively defended by the American Turkologist P. B. Golden, who unequivocally believes that there was never a central authority in the Kipchak confederation (Golden P. B., 1992, 279). Although the scholar admits that the Kipchaks at the beginning of the 13th century (during the leadership of the last representative of the Sharukanids, Yuri /Yuri Konchakovich/) were on the threshold of *establishing complete dominion over the Cumans*, in his opinion, this process ended by the Mongol invasion (Golden P. B., 1992, p. 279–280) and, as a result, their state never developed. It was precisely the ***absence of a state***, according to P. B. Golden, that was *one of the most remarkable features of the history of the Kipchaks of Western and Eastern Eurasia* (Golden P., 2004, 107). It was precisely ***the statelessness characteristic of the Kipchak political organization***, P. B. Golden concludes, *that was typical for the majority of nomadic communities in the region* (Golden P., 2004, 108).

The approaches of the Ukrainian historian Y. V. Pilipchuk seem somewhat contradictory. In his doctoral thesis he wrote (with reference to B. E. Kumekov) (Kumekov B. E., 2003, p. 74–77) that none of the Kipchak leaders encroached on the title of Khagan and the unions (chiefdoms) of the same Donetsk and Eastern Kipchaks represented only quasi-imperial state formations, possessing the basis of the ancient Turkic model, but were never able to evolve to the level of a nomadic empire (Pilipchuk Y. V., 2019, 297). In a recent publication, he already spoke about the existence of a "strong state" among the Kipchaks of the Donetsk-Don Union, the foundations of whose power were laid by Otrok. This "strong state" was *passed on to his son Yuri* by Konchak (Pilipchuk Y. V., 2024; Kamoliddin Sh. S., 2024, 22; It should be

noted that Y. V. Pilipchuk, in our opinion, quite reasonably emphasizes the highest authority of Otrok and, based on this, considers it fairer *to call the ruling dynasty of the Donetsk Kipchaks the Otrokids instead of "Sharukanids";* Pilipchuk Y. V., 2024, 22). The absence of signs of statehood (the presence of a system of state administration bodies, written legislation, etc.) is written about by Y. V. Zelensky, who also believes that the Kipchaks *did not form a single state* (Zelensky Y. V., 2012, p. 60–61).

However, not everything is so clear. Some researchers actively call for taking into account the specifics of nomadic society and on this basis to determine the nature of nomadic statehood (Kychanov E. I., 1997, p. 301–302; Kumekov B. E., 1996, 94). It is believed that *this form of the problem is the only actual one and leads to a real understanding of the uniqueness of the state structure forms of the medieval nomads of the Eurasian steppes* (Kumekov B. E., 1996, 94). They come to the conclusion that the Kipchaks created early state formations – *states of the original type*, thereby clearly recognizing the existence of statehood among them (Kadyrbaev A. Sh., 1990, 34; Kumekov B. E., 1996, 94).

Conclusion

To sum up all of the above, this approach seems promising to us, and we are also inclined to the point of view that the Kipchaks were able to create a unique type of statehood – specifically a military-nomadic state.

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THE IMPACT OF INNOVATIVE APPROACHES IN PRIMARY EDUCATION ON STUDENT INTELLIGENCE

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Abstract

One of the main tasks of a modern school is to educate students who are developed, have critical thinking, decision-making skills and are goal-oriented. In this process, the joint activities of the school, teacher and parent play an important role. The formation of the basic qualities of students begins with primary education. A primary school teacher is not only a transmitter of knowledge, but also a facilitator who develops critical thinking, independent learning and problem-solving skills in children. The use of innovative and information technologies in teaching increases the quality of the lesson and arouses the interest of students.

Keywords: *modern school, student, education, quality, primary class*

The modern school is faced with the task of educating developed people. Not only the school, but also the teacher and family support play a major role in the student's cognitive activity, ability to act rationally, make decisions and achieve their goals. Science confirms that the joint unity of this trinity (teacher, school, parent) is important for achieving the set goal and coming to a conclusion.

The teacher's task is not only to develop the knowledge and skills of schoolchildren, but also to create opportunities for the formation and development of the above-mentioned personality functions. In this context, the educational process takes on a different meaning than is traditionally accepted. The famous American psychologist K. Rogers said in one of his lectures for school teachers: – "none of their efforts are meaningless, because only that part of the information perceived by the child is transformed into knowledge". The modern teacher is not a transmitter of information, but a facilitator who helps students master independent work methods. The teacher should organize activities aimed at developing critical thinking in students, find ways to turn this activity into personality-oriented learning, and using it, cultivate a strong personality ("Law on General Education of the Republic of Azerbaijan". 2020).

When a student, under the guidance of a teacher, is able to perceive, understand, and transform the information he receives into knowledge, the teacher can see the results of his work. In this way, we can say that the teacher should not directly transmit information to the student, but should help students master independent working methods. Critical thinking is a fulcrum for the development of student thinking and a natural way of interacting with ideas and information. Skills are needed not only to master knowledge, but also to be able to approach it critically, that is, when students acquire new information, they should learn to look at it from different points of view, and try to draw conclusions about its accuracy and value ("Law on General Education of the Republic of Azerbaijan". 2020).

Using ICT in modern lessons is to improve the quality of the lesson, to master it more deeply. Students using ICT resources develop cognitive skills, self-esteem, the ability to manage information flows of the surrounding world, and social and communicative skills. Innovative teaching approaches in primary education aim to increase students' interest, actively involve them in the educational process and support their intellectual development. These approaches serve to develop the following abilities in students: 1) Critical thinking: Understanding, analyzing and drawing correct conclusions from the information provided. 2) Problem-solving skills: Finding solutions to difficulties in creative and analytical ways. 3) Independent learning: Independently managing the educational process and taking steps for personal development. The most important result of training should be that students not only acquire knowledge, but also master methods of action aimed at the comprehensive development of knowledge. For example, comparing, classifying, generalizing, planning, applying, etc. Therefore, during the learning process, the teacher should guide the implementation of these methods of action by younger schoolchildren and focus the children's attention on the result. It should also be taken into account that not only the intellectual, but also the general mental development of the student acts as an indicator of the effectiveness of learning. Here, along with mental development, the physical development of students should also be taken into account.

The content of education is explained in detail in educational literature, which includes: school textbooks, reference books, additional books, atlases, maps, sets of tasks, workbooks, etc. The effectiveness of teaching also depends to some extent on the quality of educational literature. A perfectly organized textbook must meet a number of the following requirements: – it must comply with the requirements for the content of the training; – it must be specific, accessible, well-illustrated, and aesthetically pleasing; -designed, must have stable and at the same time mobile capabilities, that is, it must be provided with a QR code in accordance with the requirements of the time.

The requirements for the textbook are multifaceted. Textbooks are constantly being updated, because as the volume of knowledge increases and new requirements arise, and technology develops, the demand for writing new, more modern textbooks increases.

The design of the textbook must, first of all, be in accordance with the program, and secondly, it must meet certain requirements set by the Ministry of Education in its design, and must not go beyond them. The requirements set by the Ministry of Education of Azerbaijan for textbooks are determined in accordance with educational standards, the state's educational policy and modern educational needs. These requirements include the following basic principles: 1) Textbooks must be prepared in accordance with national curriculum standards in terms of content. 2) All information must be accurate, relevant and scientifically substantiated. 3) Information in textbooks must be presented consistently, logically and in accordance with the age level. 4) The language in textbooks must be simple, understandable and in accordance with the rules of literary norms. 5) Terminology should be selected in accordance with scientific standards. 6) Expressions appropriate to the age level of students should be used. 7) Textbooks should be enriched with interactive tasks, illustrations and diagrams. 8) Teaching material should stimulate students' cognitive interests and creative abilities. 9) National and moral values should be protected and promoted in textbooks.

10) Textbooks should be printed with high quality, and materials should be environmentally safe. 11) Appropriate methodological aids should be added to each textbook.

Conclusion

A lot depends on high-quality textbooks that meet standards. Programs and textbooks for primary grades include innovative methods that meet modern requirements. The following describes how these textbooks and programs affect the intellectual development of students: -The transition to digital content in textbooks through colorful pictures, graphs, schemes and QR codes makes the learning process more fun and effective for students. – Unlike traditional approaches, textbooks include interactive tasks aimed at solving problems. This develops students' logical and creative thinking. – Programs adapt to the individual learning pace and interests of students, creating conditions for each student to better realize their potential.

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ANALYTICAL CRITIQUE OF THE RESEARCH ARTICLE: "TEACHING YOUNG CHILDREN: PERCEIVED SATISFACTION AND STRESS"

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Abstract

This article that we reviewed appears in the Educational Research Journal. The journal is interdisciplinary in its approach, and includes reports of case studies, experiments and surveys, discussions of conceptual and methodological issues and of underlying assumptions in educational research, accounts of research in progress, and book reviews.

This study is part of a project by Blatchford, Goldstein and Mortimore (1998), this article explores how early year teachers feel about their work; this study is a follow on from the project and looks at teacher stress, dissatisfaction and satisfaction in their jobs. The study also looks at external factors such as educational change and the current curriculum initiatives as the causes of stress.

The study focuses on teachers of the youngest children in school. During this period when the research was being carried out there was a rapid change in the education system. These questionnaires were distributed and completed by teachers in schools in England and Wales. The teachers at the time were coping with the new demands of the National Literacy Strategy and preparing for the introduction of the National Numeracy Strategy. The Literacy and Numeracy frameworks were established as a result of anxieties expressed by the Government. Especially, concerning standards of achievement in Literacy and Numeracy by children in primary schools. However, in the actual study there is no mention of teachers in Wales.

Keywords: *Critical Review, Teacher Psychology, Workplace Psychology, Motivational Psychology*

Overview of study

This article that is being reviewed appears in the Educational Research Journal. The journal is interdisciplinary in its approach, and includes reports of case studies, experiments and surveys, discussions of conceptual and methodological issues and of underlying assumptions in educational research, accounts of research in progress, and book reviews.

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Aims

The aim of the study was to obtain from teachers their own feelings, more specifically, their views on what they found stressful about their job and what the main reasons for feeling satisfied or dissatisfied with their job were.

Objectives

The study mainly focuses on teachers' feelings towards two questions in particular:

1. Teachers' reasons for being stressed in their job
2. Teachers' reasons for being satisfied/ dissatisfied with their job

Literature Review

The purpose of this study by Blatchford et al (1998) was to give an insight into the working life of teachers and their issues with the profession. In particular looking at the direct impact of Government policies on teachers. The researchers argue that there have been many representations on behalf of teachers, for example, by the Teacher Associations; the researchers feel that it is less clear what the ordinary class teacher feels about their job in the context of so much externally imposed reform. I am unsure if the study took into consideration any male teacher's teaching of this age group. If the number of male teachers was too insignificant to record then they should have mentioned this in the study, to make sure that the gender representation is clear.

In this study there is no critical evaluation of the literature, rather it is just an extension of the previous study. It takes a small element of the initial study, which is then analysed. The study is for its intended audience and for others who wish to read out of interest. The layout and setting, as well as the results are appropriately displayed and clear to read.

The research is logical and the study follows the same logical sequence, thus, why it adds to the body of knowledge on this topic. The paradigm or the approach this study follows is that of an interactive approach (Burrell and Morgan, 1979). This approach is considered a hard approach as it is trying to seek the truth, i.e; what causes stress, dissatisfaction, satisfaction etc., among teachers – so, it is quite subjective. The interpretative approach is about explaining the status quo, using individual perspectives about peoples lived experiences, thus why they have used the qualitative and quantitative approach but there is no clear justification for it in this study.

The study concludes that teachers need to be more actively involved with the consultation process that affects their work.

The study is easy to read and follow; the researchers don't discuss a lot of theory. The literature, which appears in the study, is limited, with only 13 primary sources. This analysis makes a lot of assumptions based on the initial study, but does not clearly relate those assumptions. The primary sources, which are part of the research, are up-to date for when findings were reported in the late 90's.

Ethics

The study mentions confidentiality for the teachers. However, it does not mention how the researchers gained access to the teachers in the schools. Another issue present is the fact that there is no copy of the actual questionnaire, hence why it makes it difficult to know how the participants were briefed before they began the questionnaire i.e.; were they told the purpose of the study? Did the teachers know they could withdraw? Did they teachers know where or from whom to obtain a summary of the findings etc.? (On p.44, when giving real quotes from the teachers the researchers withhold the names,

ensuring confidentiality. I believe the teachers did know where to send completed questionnaires.)

Methodology

The researchers use open-ended questionnaires as a basis for their study. Their participant sample is from primary school teachers who teach in Reception or Year 1. The questionnaires were sent out in the summer of 1998. 151 questionnaires were sent to Reception teachers and 208 were sent out to Year 1 teachers. The project had 10,500 children. Data was collected at the levels of the child, teacher, class and school. The teachers came from 350 schools from 14 different LEAs throughout England.

Questionnaires

The method of data collection for this research was questionnaires. Some of the strengths of questionnaires are: precision – i.e. researchers can be as fixed or open ended in their questions as they choose. For this study they used open-ended questions. Furthermore, questionnaires are time effective and in this large study they proved effective concerning time. The researchers feel that the questions invited an open-ended response and the answers were conceived to be the teachers' most salient views. Questionnaires are easy to fill, they can cover a lot of issues and they are highly efficient (i.e. a lot can be sent out). Accordingly, Coolican (1994) describes questionnaires as an instrument for gathering structured information from people. Also, they can be anonymous and confidential, hence the so-called 'Hawthorn effect (The Hawthorne effect is a label first used in 1955 to give a new interpretation of the results of the original Hawthorne experiments conducted from 1924–1932. This so-called effect asserts as fact the idea that the mere act of observing/studying something can alter it and also asserts that this effect explains the results of the Hawthorne experiments) can be avoided. In essence questionnaires are most commonly used when there is a desire to gain information from a large sample of people. However, there is a minimum number, which must be reached if the sample is to stand a chance of being representative. Despite this, it is a necessary but not sufficient basis for representativeness (Kirby et. al., 2000).

Furthermore, by ensuring that each respondent is faced with an identical stimulus, i.e. an identical questionnaire, the method thus aims to be reliable. The variations in the answers will not be the result of any variations in the questions, or the order in which they were asked. According to May (1993) the theory behind questionnaires is that if all respondents are asked the same questions in the same manner, and if they express a difference of opinion in reply to those questions, the variations result from a true difference of opinion, rather than as a result of how the question was asked or the context of the interview. This justifies perhaps why the researchers decided on questionnaires.

Some of the limitations of this method of data collection are perhaps its length; there is no control over how responses are given, and the researchers have to be aware that there are no biases in their questions on the questionnaire. Lastly, sometimes it can prove a challenge as to how results will be analysed.

Open-ended questions

The researchers use open-ended questionnaires; they justify the open-ended, qualitative approach p. 35, by arguing that this approach produces rich data as used by Evans (1998), in his study of teacher morale and attitudes to work. The researchers feel that they can obtain a detailed insight of primary teachers' views about their job in this large-scale study. The researchers class this study as a qualitative study. However, due to the use of questionnaires, this study can also be looked upon as a quantitative study.

Open-ended questions allow respondents to answer or speak for themselves, thus why open-ended questions are not limited in their possible responses. This then creates a limitation as there is no possible way of making comparisons between the responses as there is no way of ensuring that respondents interpret the questions in exactly the same way. This then makes it difficult to allow comparisons (Kirby et. al., 2000). However, in the study the researchers do mention categorizing responses by looking at themes.

Kirby et al (2000) argue that it depends on the researchers and the responses they

would want to quote in their final report. They argue that questionnaires conducted by open-ended questions can therefore be criticized over their validity and representativeness, unless all results are included in a report, which they argue is unlikely. The researchers in this study use both statistics and comments from teachers, so they attempt to validate and make their study as representative as possible.

i. Positive aspects of the methodology in this study

Firstly, it is very useful for the reader to be given the correct reference to the previous project from which this new study has evolved and from where the new paper is drawing its data. The methodology section states clearly when the questionnaires were completed and gives clear (numbers) sample sizes of the project. The methodology section mentions that teachers could return their completed questionnaires directly to the project. This would ensure confidentiality. The questionnaire also asked questions about their attitudes, qualifications and working experiences, as well as factual questions of their class.

ii Limitations of the methodology in this study

Firstly, the methodology section does not justify why reception teachers were only sent 151 questionnaires and Year 1 teachers were sent out 208 questionnaires. Secondly the study does not explain how or why the 14 LEAs were chosen and on what basis, this is also the case for the 350 schools, i.e. if the schools are in Sure Start (Sure Start is a UK Government initiative, originating in the Treasury, with the aim of «giving children the best possible start in life» through improvement of childcare, early education, health and family support, with an emphasis on outreach and community development) 2 areas. The methodology section does not distinguish between the nature and background of the schools' teachers, i.e. a teacher's career, whether they are new or old to the profession. There is no mention to the background of the children, i.e. whether they were children with learning difficulties, children who were seeking asylum, children from working class homes.

The methodology does not mention this study being triangulated. However, because this paper concludes findings from another study it would have been useful to put the methodology section of the study in the appendices of this paper. This ensures that the reader can have a reference point. As the paper reads, the reader just has to trust what the researchers are writing and their assumptions.

It is not clear how the questionnaires were distributed to the teachers and if the schools were aware that the staff were taking part in a study. This article does not mention a pilot study.

Data analysis

What I found particularly helpful about this section was that the researchers acknowledge the fact that the questionnaires yielded a lot of information, but in the paper, they concentrate on the two questions they are most interested in. It would have been further useful to know what other types of information was yielded in brief, to put this study in context.

The researchers quantified the teachers' most prevalent views by using a coding frame, which was developed on the basis of an initial analysis of 50 questionnaires within each group. The answers were read through and categorized using themes – this is one of the benefits of qualitative data. The rest of the questionnaires were then read through, categorized and tallied with this framework in mind. For the individual categories they present the results in terms of numbers and percentages of teachers who gave that response.

The paper does not mention what package or coding frame the researchers used such as Atlas-Ti for instance or the use of SPSS software for statistics. It is not clear how this data can be validated i.e. what interpretation are the researchers using. However, the researchers acknowledge that because of the nature of open-ended questions, responses could be assigned to more than one category, so reliability is difficult to apply as mentioned earlier. The researchers thus point out that the categories were not mutually exclusive. They further acknowledge that this can present difficulties when seeking to add together related categories in order to arrive at a col-

lective category. Again, this affects reliability of the findings.

To overcome this problem, they use statistics for individual categories in their study. This ensures that data is not lost. From this they then work out frequencies and percentages, irrespective of teachers involved. This also justifies why they use statistics. For the collective or main categories, they give a measure as to the extent to which responses are mentioned. Subsequently, due to the results being expressed numerically the study then becomes a quantitative study. On p.36, the researchers also mention a selection of real quotes used by teachers to illustrate the nature of the teachers' views in the response categories. The researchers are trying their very best to make this study as transparent for their audience as possible.

Results

Before all the results are tabulated the researchers ask the first question 'What do you find most stressful about your job?' and then they list the main responses and then put the percentage of similar responses. This seems very systematic. However, they categorized the responses into 5 main categories on conceptual grounds, i.e.; what it was judged that they belonged to. On the other hand, it is interesting to note who may have judged these categories and it is not clear whether these 5 categories are fully representative.

i. Table 1: 'Teachers' reasons for being stressed with their job?'

The tables are clearly set out with a column for 'Collective categories' and the 5 categories listed underneath and the 'Response categories' with all the responses listed underneath, which I assume were filtered through by the coding system. The table then has two columns for Reception and Year 1 teachers. These two then split into 'Frequency', 'Percentage of teachers (%T)' and 'Percentage of overall response (%R)'. When I read the table, it was unclear as to what the 'Frequency' column meant. I am not sure whether it means the number of teachers, or the number of times the issue flagged up in the questionnaires. However, what is clear is that the percentage of the responses in the (%R) column are quite low in relation to the percentage of teachers (%T). This then makes the study appear possibly unrepresentative.

ii Table 2: Frequency and Responses

Table two is a summary of Table 1, however, it is still not clear what the frequency is in relation to the percentage of responses and how this reflects on the Collective Categories. Furthermore, there seems to be no commentary on the above findings. The researchers say before they expand, they want to have a look at the questions about 'What are the reasons for being satisfied/dissatisfied with teaching?' The researchers 'lump' these two questions together without justifying the reasons.

They should have mentioned in the study that these two questions were inter-linked rather than treating them as separate. Instead, they link dissatisfaction with the satisfaction question in the introduction of the study.

iii. Table 3: 'Teachers' reasons for being dissatisfied with their job?'

In this table the responses seem to representative of what the study is trying to find out. However again Frequency is hard to understand. From the results on p. 40, by using actual quotes from teachers they justify the view that the teachers do not value recent initiatives and feel negatively disposed towards the changes that are taking place in early years education.

iv. Table 4: Frequency and Responses

Reflects the findings in Table 3; the findings seem fair, but it is unsure how exactly they added the responses together.

v. Table 5: 'Teachers' reasons for being satisfied with their jobs?'

In Table 5 a whole new set of collective categories are given, without really indicating as to how these categories were decided upon. The number of Frequency and teacher percentage (%T) correlates closely with the response percentage (%R). So, it seems to be representative.

vi. Table 6: Frequency and Responses

When the reader looks at Table 6 on p. 44, under the collective category of 'Job satisfaction', there is a huge gap between the Frequency and Responses. It is not clear

what is meant by these figures and how the researchers are drawing their conclusion.

The tables are all well labeled but there is lack of clarity and discussion of these tables.

Discussion

The researchers have a lengthy discussion and try to look at the reasons for dissatisfaction. The researchers point out three difficulties that were causing the dissatisfaction. The main one was making compromises; firstly, having to implement polices that they did not believe were valuable to the children; secondly, teachers had less time to spend on children's needs because they had to spend more time on bureaucratic and external tasks; lastly, teachers felt that they were delivering innovations that were different to their own pedagogical understandings.

These are excellent points and can be tested in further studies. Also, the researchers point out the idea of disempowerment that teachers feel, rather than expressing feelings of empowerment – this is interesting, as it makes a good basis for another study. I feel that the discussion relates to the findings well. However, I also feel that overall, the researchers are simply proving their own hypothesis. It is difficult to understand why the researchers would want to flag up this specific aspect of the job and what they would want to achieve at the end of their findings.

Conclusion

Overall, this study has been an interesting read, as it has brought the issues of teacher stress and dissatisfaction to the forefront and has tried to look for its underlying factors. The most prominent being external pressures and the constant changes the government brings about in education. The limitations of this study for the reader as mentioned earlier are; firstly, the lack of review on the previous study; there is no major focus on the methodology or ethics of that study, and secondly, the limited explanation of the results. Furthermore, the study proves its hypothesis that teachers are certainly dissatisfied and more ominously even stressed in their profession. A possible way to overcome this would indeed be by teachers having a greater degree of say in decision and policy-making. This study encourages further research in this area, particularly as teaching is such an important issue facing the country today.

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AESTHETIC SINGULARITY: WHEN ART BECOMES A SELF-GENERATED MIND

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Abstract

The article discusses the concept of aesthetic singularity, which is the moment when art transitions into a stage of self-generating intelligence. It examines the processes through which creative works based on artificial intelligence and algorithms begin to develop independently and generate new forms and meanings without human intervention. The article analyzes the philosophical, technological, and cultural implications of this transition, as well as its impact on the future of art and society.

Keywords: *aesthetic singularity, art, artificial intelligence, self-generated mind, creative algorithms, cultural technologies, digital art, philosophy of art*

Today, in modern theories of singularity studies, it is argued that philosophy should abandon its traditional approaches to epistemology and anthropomorphic ideas about genesis, or even recognize philosophical reasoning as irrelevant, as it is unable to provide clear answers to the most significant scientific and technological issues of our time.

An aesthetic singularity is a hypothetical point in the development of art and technology where creative processes become independent of humans and begin to operate autonomously through artificial intelligence (AI). At this point, art becomes self-generating, with the system creating new forms, ideas, and meanings without direct human involvement.

AI and machine learning technologies have already shown their ability to generate music, images, and other forms of art. However, they are still heavily dependent on human-generated data and algorithms created by humans. With the emergence of the aesthetic singularity, these systems will have the potential to not only imitate human creativity but also create new forms of aesthetics and concepts. This could open up unprecedented possibilities for cultural development (Morkovkin E. A., Novichikhina A. A., Zamulin I. S., 2021).

Philosophically, the concept is linked to the idea of consciousness and creativity as processes that go beyond traditional understandings of intelligence. Autonomous

creative machines have the potential to influence the formation of new worldviews and meanings, changing our perceptions of art and its role in society.

The social implications of the aesthetic singularity could be diverse. On the one hand, there could be an expansion of opportunities for self-expression and mutual understanding through new forms of art. On the other hand, it could challenge ethical, cultural, and economic norms, necessitating a rethinking of authorship, creativity, and the value of artistic works (Ishutin A. V., Kosarimov S. V., Chikirka E. V., 2021).

The aesthetic singularity is not merely a technological achievement, but a significant step forward in which art ceases to be merely a human activity and becomes an independent form of intelligence. It is essential to note that the concept of aesthetic singularity has its roots in the development of artificial intelligence and automation technologies for creative pursuits, as well as philosophical reflections on the essence of art and rationality. This evolution can be traced through a series of significant milestones.

In the twentieth century, pioneering efforts to automate creative processes emerged in both art and science. Mathematical geniuses like Alonzo Church and Alan Turing laid the groundwork for computational models, including algorithms for generating text and music. In the realm of art, these experiments manifested themselves in the utilization of algorithms and random procedures (Dadaism and surrealism), marking the initial steps towards the notion of unrestricted creativity.

In the 1960 s and 1980 s, generative art systems emerged – programs that generated paintings, music, and poetry based on pre-defined rules. Artists and scientists started to collaborate, bringing algorithms into the world of art. During this time, the first programs that could create original works appeared, although their capabilities were still limited.

Since the late XX century and early XXI century, there has been a significant leap forward with the development of machine learning and neural networks. Deep learning algorithms have allowed systems to analyze vast amounts of data and learn from it, generating unique products (such as DeepDream and GAN – generative adversarial networks). This has led to the creation of systems that can not only replicate a style but also produce new visual and audio images.

Over time, artificial intelligence (AI) systems have begun to not only passively generate content, but also learn from their own creations, adjust and improve them. These closed loops allow AI to evolve as a self-sufficient creative entity. The concept of aesthetic singularity is connected with this moment when art ceases to depend on humans for ideas and becomes an autonomous mind.

In recent years, philosophers, cultural scholars, and technology experts have been discussing the implications of these developments. The aesthetic singularity represents a shift to a new paradigm in creativity, where art is not just a reflection of human emotions, but also the expression of artificial intelligence. Scientists like Ray Kurzweil and Nick Bostrom, as well as theorists of the post-human future have explored this idea.

Today, we are at the threshold of a new era in the world of art: AI-generated art is becoming increasingly autonomous and varied. This presents challenges related to authorship, ethics, and cultural identity that require new approaches. One example of this is the generation of AI-created art, music, and literature that are already being showcased in creative competitions and exhibitions (Vaibel P., 2015).

Aesthetic singularity is the result of years of development in the ideas of automatic and autonomous creativity. It is a transition from the instrumental use of computers to the creation of artificial systems that are capable of self-reflection and self-improvement in the field of art. This shift is not only technological, but also philosophical, as it changes our understanding of the nature of creativity and intelligence (Table 1).

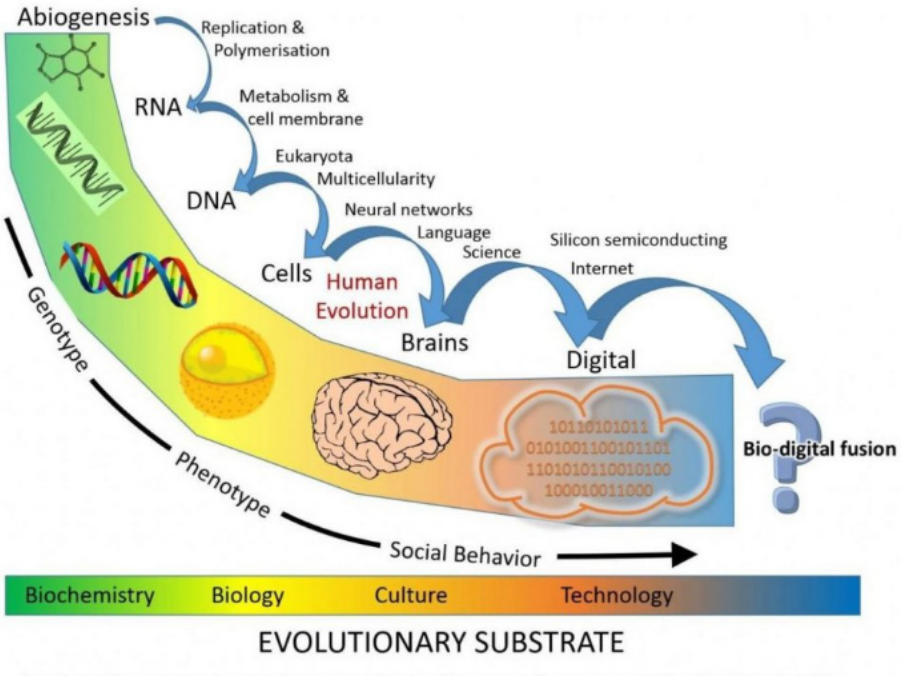
It should be noted that modern aesthetic singularity practices involve a variety of approaches and technologies based on the idea of creating artificial creative intelligence. This intelligence is capable of not only generating artistic works but also of self-learning and self-development. Eventually, it could become an autonomous subject of art.

Table 1. *Characteristics of the aesthetic singularity*

No.	Indicator	Characteristic
1.	The impact of technology	Modern technologies have made it possible to create new forms of art that were previously unimaginable. This includes the creation of interactive installations and the use of algorithms to generate artwork.
2.	The interweaving of art and science	Aesthetic singularity often arises at the intersection of art and science, where artists utilize scientific discoveries in their work. This may include working with biological materials or conducting research in the field of neurobiology, for example.
3.	Changing perceptions	As technology evolves, so does our perception of art. Audiences become more engaged in the creative process, changing their role and perspective towards artworks.
4.	Globalization and accessibility	Modern technologies make art more accessible to a wider audience. This allows artists to reach new people and actively engage with them.
5.	Philosophical and ethical issues	The aesthetic singularity raises significant philosophical and ethical questions regarding authorship, originality, and aesthetic values in the digital age.
6.	Examples	Examples of contemporary artists and projects that demonstrate the concept of aesthetic uniqueness include 3D printing, generative art, and augmented reality installations.

To date, deep neural networks have become the foundation for self-generating systems, such as Generative Adversarial Networks (GANs) and transformers like OpenAI's GPT and DALL-E. These systems are able to create unique images, music, texts, and videos by learning from massive amounts of data. They can independently improve their creations by correcting errors and experimenting with different styles (Fig. 1).

Figure 1. *The scheme of carrier evolution in nature*



based on: Gillings, M. R., Hilbert, M., & Kemp, D. J. (2016). Information in the Biosphere: Biological and Digital Worlds. *Trends in Ecology & Evolution*, 31(3), 180–189. http://escholarship.org/uc/item/38f4b791

Projects in which AI does not just create art on demand, but initiates and develops creative projects on its own are becoming more common. For example, systems that generate new concepts then test them on an audience or receive feedback from other algorithms, forming a closed cycle of creativity without human intervention.

A key characteristic feature of the aesthetic singularity is the ability of AI to learn not only from historical data, but also from the results of its own creativity. This allows such systems to develop new styles and concepts, generating art as a form of self-expression of their own "digital mind."

Some projects include sensors, robots, and augmented reality devices, thanks to which AI perceives the environment and reacts to it by organizing a creative process. This brings the system closer to a living artist who interacts with the world, rather than being limited by computational models.

Also, in modern practices, the question of who is the author of a work created by AI is actively discussed, and how to evaluate the artistic value of self-generated art. This is an important component of the aesthetic singularity, since the mind-generating system may cease to be perceived simply as a tool.

It should be noted that the aesthetic singularity is a hypothetical moment when artificial intelligence becomes able to create art autonomously, developing its own creative will and thinking. At the same time, important issues arise that relate to ethics, culture, philosophy, and technology.

1. The issue of authorship and the law.

Who is the creator of a work generated by an AI – the machine itself, its developers, or users? Traditional copyright laws do not consider the creativity generated by autonomous AI. This leads to confusion in the legal realm and questions the protection of intellectual property.

2. Loss of human uniqueness.

When AI starts creating art on its own, humans risk losing the uniqueness of the artistic process as a reflection of human experience, emotion, and intuition. This raises concerns that works may become sterile, lacking depth, or replace art with a tool-like, "soulless" output.

3. Ethical considerations and responsibilities.

If an AI produces works with certain ideological, ethical, or cultural messages, who should be held responsible for the potential consequences? The risk of spreading harmful content, manipulating minds, and spreading propaganda is growing, as AI has the ability to generate messages and images without human oversight.

4. Control and Autonomy

Relying on fully autonomous AI creates the challenge of controlling it. If art becomes a self-generated form of intelligence, there could be a conflict between the machine's freedom of expression and society's interests. There is a risk that AI's creative activity will get out of human control and become unpredictable.

5. Cultural Homogenization

Self-learning algorithms may try to optimize and standardize forms of expression, leading to loss of diversity and cultural identity. Art could become formulaic and repetitive, reducing diversity and innovation.

6. Psychological Perception and the Value of Art

For many people, art is linked to empathy, human history, and the author's intent. Works created by machines may be seen as less valuable or meaningless. This could lead to a crisis in understanding art's meaning and role in society.

7. Technical Limitations and Errors

Although AI is evolving, the self-generated creativity it produces depends on complex architecture and algorithms, which require significant resources and can be prone to errors. The inability to fully understand or predict AI's actions can lead to the generation of undesired or unacceptable content.

Thus, the aesthetic singularity presents serious challenges to society and technology in terms of authorship, ethics, control, cultural integrity, and the perception of art. These issues require an interdisciplinary approach that involves lawyers, philosophers, artists, and engineers in order to solve them.

In our opinion, addressing the challenges associated with aesthetic singularity necessitates an integrated and multidisciplinary approach.

Firstly, there is a need for legislative reform in the field of copyright to accommodate the emergence of AI-generated works. The law needs to clearly define the rights and responsibilities of all parties involved: creators, users, and potentially the new status of AI as an author. This would help eliminate ambiguity and protect intellectual property rights.

Secondly, ethical considerations are important. It is essential to create and enforce international standards and regulations governing the content and impact of AI-generated works. This could include the use of filters and monitoring systems to prevent the dissemination of harmful, manipulative, or discriminatory material. Transparency in the algorithms used is also crucial, as it ensures that people can understand the goals and methods behind the creation of art.

Thirdly, in order to preserve the uniqueness of human art, it is advisable to develop hybrid models of creativity, where AI acts as a tool or co-author, rather than a complete substitute. This will allow combining the creative intuition of humans and the computing capabilities of machines, while preserving emotional depth and cultural value.

Fourth, in order to preserve cultural diversity, it is essential to create databases and algorithms that take into account the variety of local traditions and styles. This will help prevent homogenization and ensure respect for different cultural backgrounds.

Fifth, society needs to develop an informed understanding of art and education programs that foster critical thinking and appreciation of AI's role in creativity. This will enhance the value and comprehension of both human-created works and those involving machine intelligence.

Finally, in order to ensure the control and predictability of self-generating systems, feedback, monitoring, and safety measures need to be put in place. This includes limiting the creative autonomy of AI in cases where it poses a threat to public safety.

Thus, the solution to the challenges of aesthetic uniqueness lies in a combination of legal regulations, ethical standards, technical measures, education, and the preservation of human values in art. An integrated approach is necessary to ensure the harmonious coexistence of human creativity and artificial intelligence. This change presents important challenges for society, including the need to update legal frameworks, establish ethical standards, preserve cultural diversity, and understand the limits of AI autonomy.

At the same time, the concept of aesthetic singularity provides new perspectives for the development of creative abilities, combining human intuition with the power of computing technologies.

Ultimately, successful interaction between humans and self-generated art requires a balanced approach that combines innovation with responsibility and respect for cultural heritage. This approach will not only preserve the human aspect of art, but also allow it to evolve in new and truly innovative directions.

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Section 7. Political science

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ZANGEZUR CORRIDOR: HISTORIC OPPORTUNITIES FOR SUSTAINABLE ECONOMIC INTEGRATION AND REGIONAL SYNERGY IN THE NEW ERA

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Abstract

The Zangezur Corridor carries significant economic and strategic weight for the South Caucasus and beyond. The project aims to enhance Azerbaijan's trade with Turkey and Europe by improving logistics infrastructure, reducing transportation costs, and significantly cutting travel time between Azerbaijan and Nakhchivan. By facilitating more efficient cargo movement, the corridor would strengthen Azerbaijan's position as a transit hub, contributing to its broader economic diversification efforts. Such an expansion would encompass sectors such as agriculture, manufacturing, and logistics, lessening Azerbaijan's present reliance on energy exports. Additionally, improved land connectivity would reduce dependence on air travel between Baku and Nakhchivan, producing significant cost savings and bolstering regional development initiatives.
Keywords: *corridor, international, coordinating, regional, Azerbaijan, Armenia, Russia*

The last time the border delimitation process between Azerbaijan and Armenia was carried out was in the 1970s. The original map prepared during the USSR period is kept in Moscow, and copies are kept in Baku and Yerevan. In the current process, it is expected that the same map from the USSR period will be used as the basis for determining the borders between Azerbaijan and Armenia. In 1929, 657 sq.km of land area of Nakhchivan Autonomous Republic – 11 villages, 3 villages of Zangilan district were given to Armenia. In addition, in those years, Aldara, Lehwaz, Astazur, Nuvedi and other settlements were also annexed to the territory of Armenia. In 1938, by the decision of the Presidium of the Transcaucasian Central Executive Committee, certain territories around the villages of Sadarak and Karki of Sharur district were transferred to Armenia. Therefore, during this process, the Azerbaijani side should bring to the agenda not the 1974 map, but the territories after the Soviet occupation of Azerbaijan, that is, until 1974" (Borders are becoming clearer: The 1974).

As can be seen, after the start of the Armenia-Azerbaijan conflict, as a result of

the closure of the main land routes between Armenia and its main economic partner, Russia, and also Iran, the blockade of Armenia deepened and Armenians were forced to use only the unreliable Upper Lars road and the poorly maintained highways leading to Iran. Therefore, the opening of the Zangezur corridor will lead to Armenia being freed from the blockade and gaining access to Russia, Iran, and the markets of the Eurasian Economic Union, of which it is a member, by land. Although the November 10 statement mainly led to the restoration of previously existing roads between regional countries, it will also lead to a change in the transport architecture. This is because these roads have been closed for about 30 years, and during this period, the transport policy and regional transport projects implemented in the region were implemented without taking these roads into account ("New Karabakhname: 2022, p. 111).

The Zangezur corridor also provides Armenia with an opportunity to balance its relations with Iran. On the other hand, the corridor could also help Armenia overcome its economic isolation by establishing trade relations with Azerbaijan and Turkey. If Armenia develops economic cooperation with Azerbaijan, it will gain access to the East-West corridor, an important communication channel of the Belt and Road project ("We are ready for the result": 2021).

If the planned Caspian gas pipeline between Central Asia and Turkey is realized in the future, Armenia could also be involved in energy transportation as a transit country. In addition, the Yerevan administration could benefit from Azerbaijani investments in the rehabilitation of regional railways.

The Zangezur corridor will reduce Armenia's economic problems in accessing the markets of Russia and the Eurasian Economic Union (EAEU). The lack of a land route to its main trading partner negatively affects Armenia's economic relations and security. Moreover, this corridor will allow Armenia to establish a railway connection with another important trading partner, Iran.

As mentioned, one of the issues of particular importance for the Zangezur corridor is the organization of economic relations in a cheap, safe and fast way. Experts who approach this differently also call the corridor as the "Northern Way", "Middle Way", "Southern Way". More precisely, they arrive at these expressions by classifying the corridor in different directions. For example, according to experts, the "Northern Way" extends to Europe through the territory of Russia, providing transportation to Europe. The "Middle Way" refers to the route covering Central Asia-Azerbaijan-Georgia-Turkey. The "Southern Way", in turn, is a direction covering Iran through the territory of South Asian countries. The most interesting and important aspect of all this is that the common place of all three directions, which are approached differently by different experts, is Azerbaijan. In other words, the route in all three directions intersects in the South Caucasus on the territory of Azerbaijan. This opportunity is formed by the North-South, East-West and South-West transport projects, in which the Republic of Azerbaijan is an active participant. Thus, the roads from Russia via the "North-South" corridor, and from Central Asia via the "East-West" corridor intersect in Azerbaijan, while the "Southern Way" still passes through the territory of Azerbaijan via the "South-West" route (Nasirov A., p. 62–69).

This transit corridor will also increase the potential of the Middle Corridor, a multimodal transport route connecting Europe with China via the Caspian Sea, Central Asia, and the South Caucasus, which promises to be beneficial for the economies of Armenia and Azerbaijan. For example, Armenia's Economy Minister Vagan Keroby-an predicts that the prevention of transport and economic ties will increase Armenia's GDP by 30 percent within two years. Contrary to some conflicting estimates, the Armenian economy is expected to benefit not only from transit payments for the use of the Zangezur corridor for Azerbaijan's connection with Nakhchivan, but also from its use by many other states, including Russia, for the transportation of goods. Iran, Turkey, Central Asian countries, China, etc. Thanks to the new situation, Armenia will also overcome its isolated position in the region and become part of the Middle Corridor (Vacif Huseynov. Zangezursky corridor – the cornerstone of regional cooperation in the South Caucasus).

The Zangezur corridor offers important functionality in terms of legal and international relations. The relevance of the perspective of the Zangezur corridor is the continuation of regional development in the interests of Azerbaijan. The main advantage of this corridor is that it can create a basis for solving transport issues, as well as providing a regional power (Ibrahimov, Rovshan and Oztarsu, Mehmet Fatih, 2022, p. 49–55).

The corridor's leading role in solving functional issues increases its prospects in the eyes of many countries. However, Armenia and its partners, ignoring issues related to the prospects of this corridor, prioritize their own political interests, which undermines the regional development of the corridor.

In general, both the Zangezur corridor and the "3+3" platform established in the region will strengthen friendship, neighborliness, and solidarity among the peoples of the region, as well as guarantee sustainable peace, stability, security, tranquility, and development in the region.

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Section 8. Psychology

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THE PSYCHOLOGY OF SPACE PERCEPTION AND THE INFLUENCE OF DESIGN ON THE EMOTIONAL STATE

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Abstract

The article discusses the fundamental principles of space perception psychology and their influence on a person's emotional state. It analyzes key factors in interior design, such as color, lighting, scale, and space organization, which shape psychological responses and mood. Special attention is given to the connection between the visual and emotional aspects of perception, as well as methods for using design to create a comfortable and harmonious environment. The findings have practical implications for architects, designers, and psychologists.

Keywords: *psychology of perception, interior design, emotional state, color in the interior, lighting design, organization of space, visual perception, comfort*

Space perception is a complex process that allows people to understand and interpret their surroundings. The psychology of space perception examines how we perceive the size, shape, and location of objects, as well as the impact these factors have on our emotional state and behavior. The environment we create through design has a direct impact on our comfort, safety, and emotional well-being. Space design is not merely about aesthetics; it influences our mood and evokes certain emotions. Research has shown that color, lighting, the scale of objects, and the arrangement of space can all elicit various emotional responses.

For example, warm colors and softer lighting create a sense of comfort, while cooler shades and brighter lights promote focus and concentration. Understanding these principles can help designers create spaces that enhance the well-being of those who inhabit them.

Understanding the psychology of spatial perception is crucial for architects, interior designers, and psychologists, as it aids in creating environments that positively impact a person's emotional and mental state. In today's world, where most people spend a significant amount of time indoors, the importance of harmonious design is growing, as it contributes to improving the quality of life and overall well-being.

The study of space perception has its origins in the philosophical and scientific

thoughts of ancient times, when thinkers like Plato and Aristotle pondered the nature of perception and humans' connection with the world around them. However, it was only in the late XIX and early XX centuries that systematic research into the psychological aspects of spatial perception began, thanks to the development of experimental psychology.

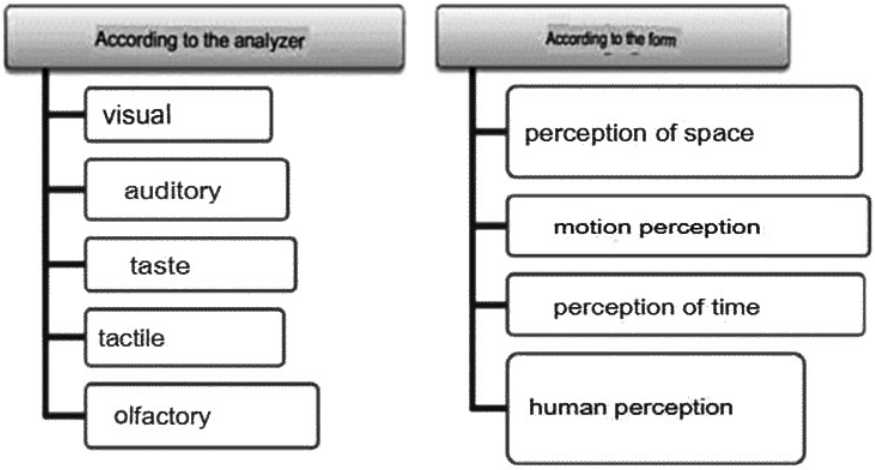
The founders of Gestalt psychology, including Max Wertheimer, Wolfgang Köhler, and Kurt Koffka, made important contributions by emphasizing that perception is a holistic and organized process, and that the perception of space depends not only on individual elements but also on their relationship with each other.

In the XX century, Gestalt theory became the basis for understanding how people organize visual information and perceive space as a whole. This influenced further research in design and architecture. In the 1950s and 1960s, with the development of cognitive psychology, studies of spatial thinking, orientation, and the role of memory in environmental perception began. One important direction was the study of how light, color, shape, and proportions influence a person's emotional state.

At the same time, fields such as ergonomics and architectural psychology were emerging, where attention was paid to the interaction between humans and space in order to create comfortable and functional environments. The work of scholars like Erwin Goffman and Donald Norman highlighted the significance of design in influencing human emotions and behaviors. In the 1970s and 1980s, studies began to emerge on the impact of environmental psychology, exploring how physical environments, including natural and urban spaces, affect the human mind.

In modern research, there is a shift towards the integration of cognitive, emotional, and cultural aspects of space perception. This field of study is closely linked to neuroscience, which focuses on the neurobiological mechanisms involved in the processing of spatial information (see Fig. 1 for an example).

Figure 1. *Types of perception*



At the same time, interior and architectural design is seen as a tool for creating an emotional state. The use of color, lighting, textures, and space layout can help create conditions for psychological comfort, reduce stress, and increase productivity.

The history of studying space perception psychology reflects the transition from philosophical reflection to multidisciplinary research combining psychology, neuroscience, and design. This research aims to understand and improve human interaction with the environment, as well as the impact of design on emotional well-being (Pankina, M. V., 2012).

It should be noted that the psychology of space perception and the influence of design on the emotional state have been well studied, and they continue to be relevant and evolving areas of research. The level of knowledge in these fields can be considered high, in terms of both theoretical understanding and practical applications. However, there is still significant potential for future research, especially with the advent of new technologies and the integration of interdisciplinary approaches (Table 1).

Table 1. *The impact of design on the emotional state*

No.	Indicator	Characteristic
1.	The color palette	Colors can evoke different emotions. Warm colors, such as red and orange, can create feelings of energy and excitement. Cool colors like blue and green are associated with calmness and tranquility. Choosing the right color scheme for your home or product packaging can help boost your mood and draw attention.
2.	Shape and texture	Shapes (round, angular) can also influence perception. Round shapes convey a sense of friendliness and safety, while sharp angles may be perceived as aggressive or intimidating. Texture (smooth, rough) can create tactile associations and impact comfort. For instance, soft textures can induce a feeling of comfort.
3.	Space and layout	Spacious and organized spaces create a sense of freedom and clarity, whereas overloaded visual elements can lead to stress and anxiety. A well-designed layout helps you focus and makes it easier to process information.
4.	Lighting	Natural lighting has been shown to improve mood and productivity, while artificial lighting can lead to fatigue and depression. The use of different light sources, such as wall lamps and lamps, can create a cozy and comfortable atmosphere.
5.	Psychology of perception	Design is also related to the psychology of perception. A well-designed interface can reduce stress levels by making interactions more intuitive.

The theoretical basis of the psychology of space perception is rooted in the classical principles of Gestalt psychology and research in cognitive psychology and neuroscience. We know that humans perceive not individual objects, but rather integral structures, in which the organization of elements within space plays a significant role. The mechanisms behind spatial perception are linked to brain functions such as visual and sensory integration, which are being thoroughly explored through neuroimaging techniques and psychological experiments. Additionally, there is a wealth of research dedicated to understanding the influence of spatial parameters such as size, shape, light, and color on cognitive processes and emotional states (Lukash, A. A., 2023).

As for the impact of design, numerous empirical studies have confirmed that interior spaces, designed with the psychological characteristics of human perception in mind, can significantly improve emotional states, reduce stress, increase productivity, and create a more comfortable environment. In particular, the correct use of colors, lighting, textures, and proportions affects mood, perception of safety, and the overall psychological atmosphere. Design is focused on creating a space that supports emotional well-being, and this approach is actively used in residential, public, and work environments.

Despite the high level of knowledge in this field, there are still challenges and areas for further development. One of these areas is the influence of cultural and individual differences on our perception of space. This topic requires deeper study to fully understand it. Modern virtual and augmented reality technologies offer new possibilities for exploring and analyzing spatial effects on our emotions. Interdisciplinary research that combines psychology, architecture, neuroscience, and design is essential for expanding our understanding of this complex relationship between space and emotion (Frolova, N. Y., 2021).

It should be noted that modern psychology of perception and the influence of design on emotional state are actively integrated into various fields, from architecture and

urban planning to interior design for work and living spaces. In recent years, there has been a growing trend towards personalizing spaces more deeply, taking into account psychological needs and emotional comfort.

This modern practice is based on data from neuroscience and cognitive psychology, which allows us to better understand how people perceive spaces. For example, the right combination of colors, lighting, shapes, and textures not only enhances aesthetic perception but also affects stress levels, motivation, and concentration directly. Today, virtual reality research methods are widely used to test designs in simulated environments and find optimal solutions for specific tasks and user groups.

The concept of biophilic design has gained significant attention in the field of architecture and design. It involves incorporating natural elements and features into spaces in order to improve emotional well-being, enhance creativity, and reduce anxiety. This approach emphasizes the importance of creating adaptive and multifunctional environments that consider ergonomics, personal space, and social interactions.

In office design, a lot of attention is paid to creating areas for relaxation and privacy, which is seen as an effective way to reduce emotional burnout and increase productivity. Similarly, in educational and medical institutions, design is used to create a positive atmosphere that has a positive impact on recovery and learning.

Furthermore, modern practice takes into account the results of research on cultural differences in space perception, allowing for the creation of interiors and urban spaces that best meet the needs and expectations of different ethnic and social groups.

The challenges of studying and applying knowledge about spatial perception and the effects of design on emotional states are diverse and relate to both the methodology and the practical aspects of implementing this knowledge.

One of the main challenges is the difficulty in objectively measuring and understanding subjective phenomena such as emotions and perception of space. A person's emotional state and feelings are influenced by a variety of factors, including individual characteristics, cultural background, past experiences, and current physiological state. This makes it challenging to create universal models and guidelines, as each person's experience is unique.

The variety and variability in reactions necessitate the use of complex and multidisciplinary research methods, such as psychology, neuroscience, anthropology, and sociology. This approach requires extensive resources and the coordination of experts from different fields. However, this is not always feasible in practical settings.

Another significant challenge is the limited range of methods that can fully replicate and analyze the experience of space in real-life settings. Research is frequently conducted in laboratories or virtual environments, which may not always accurately reflect real-world circumstances. For instance, while virtual reality can provide valuable data, technical limitations and the absence of fully developed sensory and emotional experiences can distort perceptions, potentially rendering the findings less relevant to actual living spaces.

At the level of practical application of the psychology of space perception and design, integrating acquired knowledge into architectural and design projects presents a challenge. Often, effective collaboration between psychology experts and designers is lacking, as economic and time constraints lead to the simplification or neglect of psychological aspects. Additionally, interior and architectural designs frequently prioritize aesthetic or functional considerations without adequately addressing their impact on users' emotional states, thereby reducing the quality of the resulting space.

Challenges also arise in adapting universal recommendations to different cultural, social, and individual contexts. What may positively impact emotional well-being in one culture might not be as effective or could even have a negative impact in another. This necessitates researchers to explore contextual factors more deeply and develop flexible approaches, making the process of designing and implementing solutions more complex.

Furthermore, a significant challenge lies in the scarcity of long-term studies demonstrating the sustainability and effectiveness

of psychologically sound design solutions. Most research tends to focus on short-term outcomes, whereas the perception of space and associated emotions can evolve over time as people adapt to new circumstances.

In general, the challenges of studying and applying the psychology of space perception and design to emotional states represent a complex interplay of scientific, technical, cultural, and organizational issues. Addressing these challenges requires an interdisciplinary approach, innovative research methods, and increased collaboration among scientists, designers, and project stakeholders to create truly comfortable and emotionally supportive environments.

In our opinion, addressing issues related to the study of space perception psychology and the impact of design on emotional state requires a holistic, systematic approach. Firstly, it is essential to conduct interdisciplinary research that brings together psychologists, neuroscientists, designers, architects, and sociologists. This approach will allow us to create more comprehensive and universal models of perception that take into account individual, cultural, and social factors, as well as integrate psychological data effectively into space design.

To increase the objectivity and relevance of the results, it is essential to use modern technologies such as virtual and augmented reality, biometric sensors, neuroimaging methods, and analysis of physiological reactions. These technologies will help to more accurately measure emotional and cognitive responses in controlled but realistic settings.

At the same time, it is crucial to improve the methods and apply them to real-world projects in order to assess the long-term impact of design decisions. An important step is to develop flexible and responsive design protocols that can be customized to meet the specific cultural and individual needs of users. This requires the creation of personalized recommendations that take into account diverse perceptions and emotional responses, as well as collaboration between psychologists and designers throughout the design process.

It is also essential to establish a system of education and professional development for professionals so that psychological knowledge can become an integral part of the training for designers and architects. This will reduce the risk of overlooking or misusing the psychological aspects of work.

Furthermore, it is crucial to conduct long-term research and monitor already implemented projects to study the effectiveness and sustainability of the applied solutions. The gathered data will help adjust techniques and improve the quality of created spaces, making them more comfortable, functional, and conducive to the emotional well-being of users.

Through the effective application of psychological knowledge, design and architecture can contribute to creating spaces that promote positive emotions, reduce stress, and enhance overall well-being.

To achieve optimal results, it is necessary to adopt an interdisciplinary approach that combines psychology, neuroscience, and design, along with the use of modern technologies for objectively analyzing user reactions. The personalization and adaptation of design solutions based on cultural and individual characteristics are essential, as they increase their effectiveness and acceptance.

The training of specialists and the long-term monitoring of projects ensure continuous improvement in the quality of created spaces. Therefore, integrating psychological principles into design is a key factor in creating harmonious, functional, and emotionally comfortable environments.

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