POLISH JOURNAL OF SCIENCE
№68 (2023)

ISSN 3353-2389

Polish journal of science:

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1000 copies
POLISH JOURNAL OF SCIENCE
Wojciecha Górskiego 9, Warszawa, Poland, 00-033
email: editor@poljs.com
site: http://www.poljs.com

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ВИКОРИСТАННЯ РІЗНИХ СХЕМ СИНХРОНІЗАЦІЇ ОХОТИ В ПРОМИСЛОВОМУ СВИНАРСТВІ

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USE OF DIFFERENT ESTRUS SYNCHRONIZATION SCHEMES IN INDUSTRIAL PIG FARMING

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Анотація

У статті було вивчено вплив різних схем синхронізації охоти на час настання охоти у свиноматок. Було встановлено, що застосування комбінованої гормональної обробки (альтреногест з простагландином або фолікуло-стимулюючим гормоном (ФСГ) відповідно) зменшує інтервал між останнім введенням альтрезину та настанням охоти. Кращі результати були отримані у II дослідній групі, де 100% тварин мали ознаки охоти на 3-4-й день після застосування альтрезину. У I і III групах, відповідно, у 93,33% та 45,45% підсвинків відбулося настання охоти на 4-й і 5-й день.

Abstract

The article studied the influence of different farrowing synchronization schemes on the time of farrowing in sows. It was established that the use of combined hormonal treatment (altrenogest with prostaglandin or follicle-stimulating hormone (FSH), respectively) reduces the interval between the last administration of altresin and the onset of heat. The best results were obtained in the II experimental group, where 100% of the animals had signs of hunger on the 3-4th day after the use of altrezin. In groups I and III, respectively, in 93.33% and 45.45% of piglets, the onset of hunger occurred on the 4th and 5th day.

Ключові слова: синхронізація охоти, свині, альтрезин, простагландин, ФСГ.

Keywords: estrus synchronization, gilts, altrenogest, prostaglandin, FSH.

Вступ. Відтворення свиней – це один з ключових етапів вирощування цих тварин, і востаннє десятиліття свідчить про зростаючий інтерес до використання біотехнологій в свинарстві [3, 7].

Розуміння фізіології репродукції свиней та оптимальних умов для розмноження має велике значення для досягнення успіху у цій галузі [1, 4]. Репродуктивна здатність свиней може бути частково обумовлена зовнішніми факторами, такими як годівля, умови утримання, стан здоров'я та стрес. Правильна збалансована годівля забезпечує належний рівень енергії та поживних речовин, необхідних для репродукції. Особливу увагу слід звернути на достатнє надходження в організм вітамінів та мінералів, таких як вітамін Е, цинк та селен, які мають важливе значення для репродуктивної функції.

Аналіз досліджень і публікацій. Основними елементами інтенсифікації системи відтворення свиней є застосування заходів, в тому числі і біотехнологічних методів, що сприятимуть збереженню та вирощуванню поросят, збільшенню кількості опоросів на матку, впровадженню штучного осіменіння та вдосконаленню структури стада [2, 5].

Значно підвищує ефективність роботи в свинарстві стимуляція відтворювальної функції свиноматок. З цією метою використовують як гормональні, так і негормональні методи. Якщо негормональні методи легше організувати в умовах господарств, то гормональні широкого розповсюдження ще не отримали [6].

Визначення оптимального часу для штучного осіменіння свиноматок є дуже важливим етапом, оскільки це визначає успішність процедури і впливає на наступний статевий цикл. Перед введенням сперми необхідно підготувати самку. Це може включати синхронізацію охоти, контроль статевого циклу та застосування гормональних препаратів для забезпечення оптимального часу для запліднення.

Загалом, біотехнологічні методи інтенсифікації відтворення свиней відкривають нові перспективи для свинарства, допомагаючи підвищити продуктивність, покращити якість та забезпечити стійкість господарства. Вони є цінним інструментом для господарств, які прагнуть досягти високої ефективності та конкурентоспроможності на ринку.

Продовження використання біотехнологій відтворення свиней вимагатиме подальших досліджень, розвитку технологій та удосконалення процесів для максимального використання їх потенціалу [5].

Методика виконання роботи. Дослідження щодо ефективності використання різних схем синхронізації охоти та регуляції статевого циклу свиней проводилося в червні 2023 року на 36 помісних (ландрас × дюрок) перевіряємих свинках віком 200-210 днів в умовах підприємства «Hvidfeldtgaard» (місто Рудкьобінг, Данія). Піддослідних тварин розділили на три групи (табл. 1).

У всіх групах синхронізація охоти була проведена препаратом альтрезин (Altresyn® – продукт на основі прогестерону, діюча речовина – альтреногест) після попередньої охоти індивідуально перорально примусово безпосередньо в ротову порожнину у дозі 5 мл (20 мг альтреногесту) на тварину один раз на добу протягом 21 доби.

Таблиця 1

Схема досліду

Група	Кількість тварин (n)	Схема гормональної регуляції
I (контрольна)	10	альтрезин (після попередньої охоти індивідуально перорально примусово безпосередньо в ротову порожнину у дозі 5 мл (20 мг альтреногесту) на тварину один раз на добу протягом 21 доби)
II (дослідна)	12	альтрезин (після попередньої охоти індивідуально перорально примусово безпосередньо в ротову порожнину у дозі 5 мл (20 мг альтреногесту) на тварину один раз на добу протягом 21 доби) + просольвін (внутрішньом'язева ін'єкція в дозі 0,75 мг через 24 години після припинення застосування альтрезину)
III (дослідна)	14	альтрезин (після попередньої охоти індивідуально перорально примусово безпосередньо в ротову порожнину у дозі 5 мл (20 мг альтреногесту) на тварину один раз на добу протягом 21 доби) + фолігон (внутрішньом'язева ін'єкція в дозі 500 МО одній тварині)

Ремонтним свинкам I групи (n=10) синхронізацію проводили лише альтрезином. Свинкам II групи (n=12) через 24 години після припинення застосування альтрезину внутрішньом'язево вводили просольвін (Prosolvin – містить синтетичний аналог простагландіна F2a люпростіол з більш вираженою лютеолітичною активністю) в дозі 0,75 мг. Група III (n=14) отримувала одну ін'єкцію фолігону (Folligon – діюча речовина гонадотропін сироватки жеребних кобил (ГСЖК) із властивостями фолікулостимулюючого (ФСГ) та лютеїнізуючого (ЛГ) гормонів) у дозі 500 МО одній тварині.

Групи тварин утримували окремо в однакових умовах. За піддослідними тваринами спостерігали до першого виявлення клінічних ознаки тічки. Тічку виявляли за допомогою кнура-пробника двічі на день після припинення гормональної терапії.

Свинок осіменяли штучно перший раз через 10 годин після виявлення тічки та другий – на 21 день. Поросність визначали через 28 днів після осіменіння за допомогою переносного приладу ультразвукової діагностики (УЗД). За всіма поросними свинками спостерігали і, за тиждень до опоросів, їх переводили в окремі бокси.

Визначали такі показники: день початку охоти (днів), тривалість охоти (годин), частота настання наступної охоти (%), частота поросності (%).

Статистичний аналіз проводили за допомогою табличного редактора MS Office Excel 2019.

Результати досліджень та їх аналіз. Було визначено день настання охоти після введення альтрезину (рис. 1).

Встановлено, що застосування комбінованої гормональної обробки (альтреногест з простагландином або ФСГ відповідно) зменшує інтервал між останнім введенням альтрезину та настанням охоти. Кращі результати були отримані у II дослідній групі: 100% тварин мали ознаки охоти на 3-4-й день після застосування альтрезину, середнє значення склало 3,33±0,148 днів. У I і III груп, у 93,33% відповідно та 45,45% підсвинків відбулося настання охоти на 4-й і 5-й день із середнім значенням 4,50±0,283 та 4,21±0,194 доби відповідно.

За допомогою проведеного однофакторного дисперсійного аналізу було визначено такі статистичні параметри, як сума квадратів, середньоквадратичне значення, F-статистика та коефіцієнт детермінації.

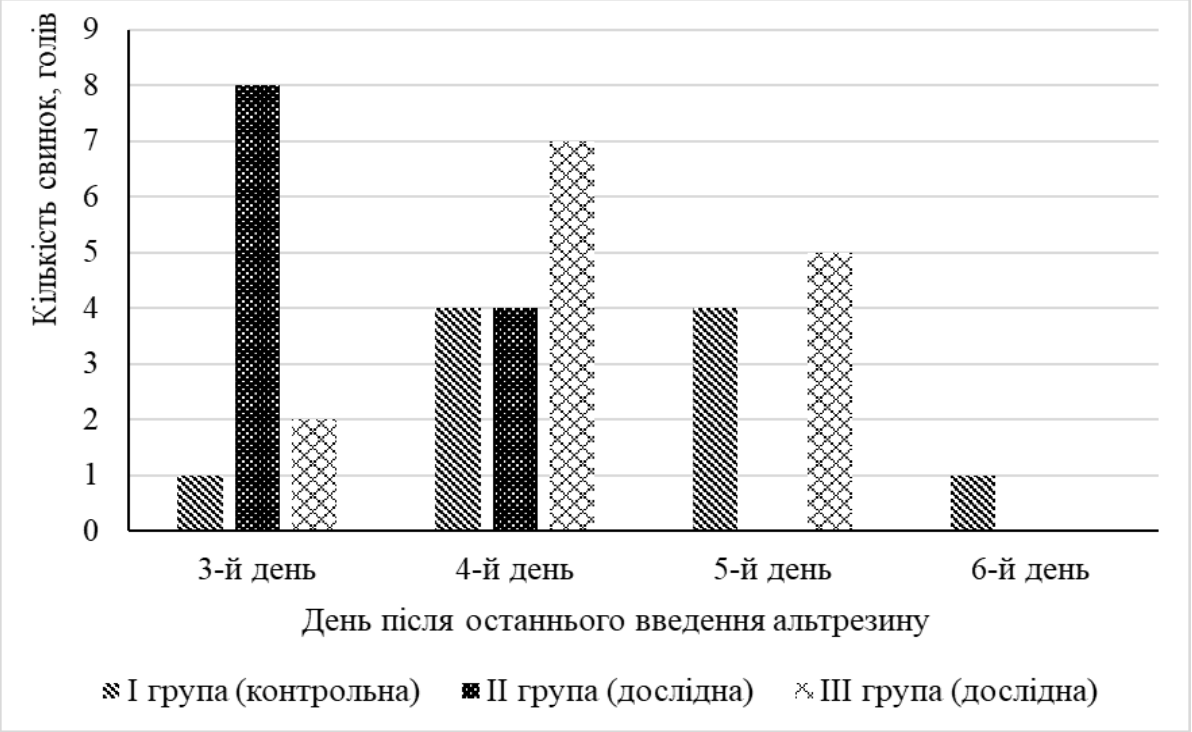

Рис. 1. Розподіл перевіряємих свинок після застосування різних схем синхронізації охоти

Ці значення використовуються для оцінки статистичної значущості впливу використання різних схем синхронізації охоти на мінливість часу настання охоти (табл. 2).

Таблиця 2

Вплив застосування різних схем синхронізації охоти на мінливість часу настання охоти

Показник	*SS*	*df*	*MS*	$F_{розрах.}$	η^2
День настання охоти після останнього введення альтрезину	8,48	2	4,238	9,01***	35,3

Встановлено вірогідний вплив застосування різних схем синхронізації охоти на мінливість часу настання охоти, частка впливу складає 35,3%.

Наступна таблиця представляє результати дослідження, в якому було вивчено вплив введення альтрезину на охоту (табл. 3).

Таблиця 3

Показники відтворення свиней за різних схем синхронізації охоти

Показник	Група тварин		
	I (контрольна) (n=10)	II (дослідна) (n=12)	III (дослідна) (n=14)
День настання охоти після останнього введення альтрезину, днів	4,50±0,283	3,33±0,148**	4,21±0,194
Тривалість охоти, годин	27,43±1,98	26,06±2,27	25,55±2,33
Частота настання повторної охоти, %	60,00	58,33	35,71
Частота настання поросності, %	40,00	50,00	92,86

У кожній групі визначали наступні показники: день настання охоти після останнього введення альтрезину (в днях), тривалість охоти (у годинах), частота настання повторної охоти (у відсотках) і частота настання поросності (у відсотках).

Результати показують, що в обох дослідних групах (II та III) було виявлено статистично значущі зміни в день настання охоти після введення альтрезину, в порівнянні з контрольною групою (I). Також спостерігалася зміна тривалості охоти у дослідних групах.

Частота настання повторної охоти і частота настання поросності також відрізнялися між групами, але відмінності не були статистично значущими у всіх випадках.

Отже, нами доведено вплив застосування комбінованої гормональної обробки (альтреногест з простагландином або ФСГ відповідно) на такий показник відтворення свиней, як день настання охоти після останнього введення альтрезину.

Висновки. Встановлено, що застосування комбінованої гормональної обробки (альтреногест з простагландином або ФСГ відповідно) зменшує інтервал між останнім введенням альтрезину та настанням охоти. Кращі результати були отримані у II дослідній групі: 100% тварин мали ознаки охоти на 3-4-й день після застосування альтрезину, середнє значення склало 3,33±0,148 днів. У I і III груп,

у 93,33% відповідно та 45,45% підсвинків відбулося настання охоти на 4-й і 5-й день із середнім значенням 4,50±0,283 та 4,21±0,194 доби відповідно.

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ARCHITECTURE

СКУЛЬПТУРА У ФОРМУВАННІ ІДЕНТИЧНОСТІ ГРОМАДСЬКИХ ПРОСТОРІВ МІСТА

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SCULPTURE IN FORMING THE IDENTITY OF PUBLIC SPACES OF THE CITY

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Анотація

У статті висвітлено дослідження вивчення ролі скульптури у сенсі ідентичності в міському плануванні. Розглянуто архітектурно-планувальні закономірності скульптури у пошуках ідентичності під час формування громадських просторів міста. Різні архітектурні засоби утвердження ідентичності встановлення скульптури, як якісного елемента відновлення міста на прикладі м. Івано-Франківська. Розташування як аспекту простору, який зайнятий чимось або кимось і має виміри значення цінності та місце, де взаємодіють функція та значення простору. Дослідження ролі міської скульптури у формуванні почуття ідентичності в сучасному урбанізмі, та необхідності вивчення її історії, передумов та причини їх появи в місті.

Abstract

The article highlights the study of the role of sculpture in the sense of identity in urban planning. The architectural and planning regularities of sculpture in search of identity during the formation of public spaces of the city are considered. Various architectural means of establishing the identity of the installation of the sculpture as a quality element of the city's restoration on the example of the city of Ivano-Frankivsk. Location as an aspect of space that is occupied by something or someone and has dimensions of value value and where the function and value of the space interact. Study of the role of urban sculpture in the formation of a sense of identity in modern urbanism, and the need to study its history, prerequisites and reasons for their appearance in the city.

Ключові слова: міська скульптура, міський простір, ідентичність, форма.

Keywords: urban sculpture, urban space, identity, form.

Вступ

Важливою ознакою скульптури громадських просторів нашого часу стала активна реконструкція великих міст, зокрема їхніх центральних історичних районів. Великомасштабна реконструкція центрів неодмінно призводить до радикальної трансформації історичного довкілля, значної зміни умов життя населення, глобалізації та підвищення суспільного значення проблеми охорони культурної спадщини. Соціально-культурне значення та структурна складність історичних міських громадських центрів, а також особливості їхнього багатофункціонального та об'ємно-просторового розвитку вимагають значно глибшого наукового обґрунтування архітектурних та проектно-планувальних рішень.

Архітектурні властивості скульптурної пластики громадських центрів міст є матеріалізованим виразом тривалого історичного розвитку країни і відображають зміни політичних, соціальних та економічних умов і чинників. Історія свідчить, що тривалий процес формування міських громадських центрів тісно пов'язаний з ідейно-політичними перетвореннями у суспільстві. Отже, є нагальна потреба у розвитку та удосконаленні теорії архітектури з врахуванням нових знань щодо закономірностей розвитку міст та їхніх структурних складових, зокрема громадських центрів.

Сьогодні переважна більшість наукових робіт з вивчення скульптури в архітектурі громадських просторів міста належить до функціонально-типологічного або історико-мистецтвознавчого напрямків. Значно менше авторів розглядають узагальнені культурологічні аспекти теорії архітектури із урахуванням змін і реальностей, характерних для початку XXI ст. Саме на урахуванні цих особливостей ґрунтується це дослідження.

Метою цього дослідження є вивчення ролі скульптур у сенсі ідентичності в міському плануванні, а методом дослідження був огляд літератури. Результати показують, що скульптура відіграє важливу роль у стабілізації або руйнуванні значення ідентичності в місті.

Основна частина

З-поміж культурологічних категорій мистецтва та архітектури виділяється універсальне поняття "ідентичність" (від латинського слова idem – тотожне), яке характеризує взаємодію окремої особистості або спільноти з архітектурним довкіллям. Це загальне поняття дає можливість більш досконало, під новим кутом та у ширшому діапазоні

розглянути процеси формування міських громадських центрів у зв'язку із збереженням їхнього історичного контексту [1].

Важливим «форматом» представлення образів минулого (і не лише минулого, а навіть ідеалізованих уявлень про сучасний і майбутній суспільний лад та спосіб життя) є також символічний простір, особливо — міський простір.

Як відомо, скульптура, як вид мистецтва, створює об'ємні художні форми у реальному просторі. Її об'єкт – переважно людина, лише іноді анімалістичний жанр, ще рідше – натюрморт чи пейзаж. Розрізняють два роди скульптур – круглу і рельєфну. Остання розташовує об'ємне зображення на перпендикулярній до площини лінії. Кругла ж скульптура являє собою тривимірну модель (статуя, група статуй, бюст), яку можна оглядати з різних кутів.

Кожен пам'ятник — це мистецький твір. Він має бути переконливим, впливати на людей, змушувати зупинитися і задуматися.

Сила скульптури в тому, що це увічнена пам'ять. Іноді скульптури ставлять, а потім зносять як потрібну або непотрібну пам'ять [2].

Іншими функціями скульптури можна назвати концептуалізацію пам'яті як категорії переосмислення темпоральності. Тут для мистецтва з'являється необмежений простір, адже воно, по суті, протистоїть часу, є засобом, що комунікує через час і поза часом.

«Місто – це дискурс, воно є насправді мовою, воно розмовляє зі своїми мешканцями, а ми розмовляємо за допомогою нашого міста, просто мешкаючи в ньому, ходячи вулицями, дивлячись на місто. Та проблема – в тому, щоб із цієї суто метафоричної стадії вийти на таке змістовне поняття, як мова міста. Легко говорити про мову міста метафорично, як говорять про «мову кіно» або «мову квітів». Але справжній науковий прорив станеться, коли можна буде говорити про мову міста не метафорично, а так, як Фрейд, коли першим заговорив про мову сновидінь, звільняючи це поняття від його метафорики й надаючи йому реального змісту. Перед нами та ж проблема: як перейти від метафори до аналізу, коли говоримо про мову міста» [3].

Розвиток міста виражається не тільки у фізичних змінах простору, але й через продукування та зміну символів і образів, асоціацій і наративів. Нині зміни відбуваються швидкими темпами внаслідок процесів глобалізації та інформатизації, які зумовили розвиток мультикультуралізму, що проникає у міський простір перш за все через міграції населення та розвиток засобів комунікації.

Одним із проявів трансформації соціокультурного простору міст є розвиток скульптурного мистецтва, яке, як мистецька практика, має тривалу історію, але увагу наукової спільноти отримало лише у другій половині XX ст.

Як уже було сказано, у роботі визначається та використовується поняття "ідентичність" у його загальноприйнятому значенні для з'ясування впливу історичних, культурологічних, ментальних, соціальних та ідейно-політичних передумов на формування та сприйняття скульптури в архітектурі громадських центрів міст у певний історичний період розвитку. Одним із прикладів є місто Івано-Франківськ.

Найбільшою цінністю тут є історична атмосфера центральноєвропейського провінційного міста, а не суцільні квартали давньої забудови чи визначні пам'ятки архітектури. Усі давні мандрівники у подорожніх нотатках згадували про велику кількість садів та квітників у цьому місті. Впродовж останніх двох століть міська влада особливо дбала про озеленення вулиць та закладання парків і скверів, якими милуємося й досі.

Місто невелике, але тут можна затриматися надовго, милуючись сентиментальними фрагментами європейської архітектури, оглядаючи багату колекцію сакрального живопису художнього музею чи зануритись у атмосферу мистецьких галерей та чисельних сувенірних крамничок, де продаються унікальні вироби народних майстрів. Отже, будучи частиною великої України, Франківськ є цілком унікальною територією.

Впродовж кількох століть тут жили разом українці, поляки, євреї, вірмени, німці, чехи та росіяни. Уся ця галицька політкультурність, одночасне співіснування різних націй, віросповідань, мов та історій, які жили поруч не заперечуючи, а збагачуючи один одного, дивовижним чином поєднується з тим фактом, що сучасний Франківськ – одне з «найукраїнськіших» міст України.

Ідеальне місто потребує ідеальної площі. Такими були міркування станиславівців у XIX столітті, коли місто остаточно втратило фортифікації і стрімко почало виходити із своїх початкових меж. Там, де ще недавно були укріплення, у 1870 році сформували площу, яка поступово перетворилася у найвишуканіший сквер.

Точкою збору, яка надала і площі, і навколишнім будинкам, і квітникам майже класичної перспективи, став пам`ятник Адамові Міцкевичу, найвидатнішому польському поетові. Він вважається найстарішим за часом спорудження зразком міської скульптури в місті та майже одноголосно всі визнають найвдалішим монументом. Пам'ятник вписується в архітектурне оточення, а також найбільш наближений до традиційних європейських монументів.

Пам'ятник Адамові Міцкевичу, Станиславів, 1904 р.

Пам'ятник Адамові Міцкевичу, Івано-Франківськ, 2021 р. [4]

Польська громада міста, пам`ятаючи колишню велич Станиславова, дуже опозиційно ставилася до австрійської влади. Тому встановлення пам`ятника великому поетові і пророкові Польщі мало особливе значення. Зібрані пожертвування дозволили оголосити конкурс, на якому переміг скульптор із Кракова Тадеуш Блотницький, а також придбати для будівництва скульптури вісім тонн італійського каррарського мармуру. Пан Блотницький при роботі використовував посмертну маску Міцкевича. Пам'ятник на елегантному п'єдесталі відкрили до сотої річниці з дня народження Міцкевича – 1898 році. Під час українсько-польської війни 1918-1919 років мармурова фігура була суттєво пошкоджена. Тому у 1930 році поляки відновили його у бронзі.

З того часу пам`ятник Міцкевича перетворився на важливий символ міста в якому поет ніколи й не був. У роки Другої світової війни патріоти міста переховували бронзового поета у таємному місці, щоб у жодної з ворогуючих сторін не виникло спокуси переплавити бронзу на снарядні гільзи.

У радянські часи Міцкевич, якого дозволяла вшановувати радянська влада, став міським улюбленцем. Різко контрастуючи з соціалістичною естетикою, він надавав скверові людяного, європейського шарму. Довкола пам'ятника досі тулиться вечірнє романтичне життя, лавочки традиційно окуповують закохані пари, а сам сквер франківським сленгом називався «плащ», що можна асоціювати як з польським «пляц» (площа) , так і з незмінним плащем бронзового Міцкевича [4].

Тому потрібно сказати про тенденції в міській скульптурі, адже в сучасних умовах свободи слова та творчості міська скульптура стала відображати вподобання суспільства, його соціокультурні цінності й моделі поведінки. У міській скульптурі сьогодення відображені ті ідеї та образи, які населення міст хоче бачити в просторовому оточенні свого життя.

Таким чином, сучасна практика української скульптури підтверджує її високий професіоналізм й активну інтеграцію до європейського художнього

процесу, а міська скульптура декларує, що символами української культури.

Іншими функціями скульптури можна також назвати концептуалізацію пам'яті як категорії, переосмислення темпоральності. Адже воно, по суті, протистоїть часу, є медією, що комунікує через час і поза часом. У таких скульптурах паралельно з пошуком національної ідеї, героїв і власної ідентичності, відродженням українських традицій та культури, що було дуже актуально в 90-х роках XX століття, відобразились особливі симпатії до певних літературних і кіноперсонажів, що знайшли відгук у душах сучасних українців [5].

Під культурним потенціалом міста ми розуміємо здатність міської спільноти до розвитку через усвідомлення самого себе. Перехід до такого розуміння неодмінно означає, що від формальної інтерпретації культури як чогось зовнішнього, до чого можна лише долучитися, ми робимо спробу пересунутися в сутнісну інтерпретацію культури як міського світу. Вже тому програма розвитку культури міста не може ігнорувати стан і характер міського середовища в її минулому й сьогоденні.

Нестандартно до теми пам'яті про загиблих підійшов автор скульптури страченим патріотам в Івано-Франківську Володимир Довбенюк. Її встановили у 2003 році в пам'ять про українців, розстріляних німецькими окупантами під час постановки оперети Ярослава Барнича «Шаріка» у Станіславівському театрі імені Івана Франка.

Тоді нацисти арештували понад 140 глядачів у вишиванках. 17 листопада 1943 року неподалік театру 27 патріотів розстріляли. У підніжжі скульптури викарбувано перелік імен та прізвищ страчених патріотів. Нині вулиця теж названа на їхню честь – Страчених Націоналістів.

Пам'ятний знак страченим українським націоналістам у центральній частині міста Івано-Франківська

Володимир Довбенюк зобразив у скульптурі одного зі страчених патріотів – з руками за спиною та мішком на голові. Значна частина активних мешканців міста сприйняли цю роботу як невиразну та чекали на встановлення більш промовистого та конкретного пам'ятника. На щастя, скульптуру залишили. Нескорена постать патріота змушує уявляти, додумувати й співпереживати [6].

Нерідко їх руйнують, як невдалі приклади, і згадують лише на сторінках підручників чи спеціалізованої літератури. Деякі відновлюють, незважаючи на те, що час позбавив їх колишньої краси й привабливості. Класифікація скульптури дала нам можливість визначити приналежність конкретної з них до певної групи з подібними ознаками, спростивши в майбутньому в практичному відношенні проектування нових територій у просторі міста, у теоретичному: підготувати базу для детального вивчення пам'ятників у взаємозв'язку із середовищем [7].

Висновки

Рухаючись від антропоморфізованих уособлень колективної пам'яті до абстракції й безпредметності, залучаючи до діалогу авдиторію, скульптура в міському середовищі осмислює й концептуалізує пам'ять, шукає для неї нову естетику у просторі та поза ним.

Хороший громадський простір – той, який відображає різноманітність та спонукає людей до спільного життя, створюючи необхідні умови для сталості, що заохочує людей бути на вулиці. Ця живучість просторів, приваблює людей. Те, що гарантує цю живучість – це можливість користуватися міськими просторами різними способами.

Звідси витікає перша та головна сучасна тенденція до проєктування скульптур у громадських просторах. Підхід, який націлений на те, аби люди приймали безпосередню участь у його творенні, адже саме вони будуть його використовувати, він повинен бути запроектований з урахуванням їх побажань та їхнього бачення. Саме місцева ідентичність наразі є пріоритетною у проектуванні громадських просторів, досягається шляхом спостереження та вивчення місцевих культурних особливостей.

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BIOLOGICAL SCIENCES

USE OF SYNTHETIC PLANT GROWTH REGULATORS IN AGRICULTURE AND BIOTECHNOLOGY

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DOI: 10.5281/zenodo.10131991

Abstract

An urgent task of modern agriculture and biotechnology is the development of new environmentally friendly plant growth regulators to increase the growth and yield of plants and protect them from abiotic and biotic stress factors. Synthetic plant growth regulators Ivin, Methyur and Kamethur based on pyridine and pyrimidine derivatives are the most promising environmentally friendly biologically active compounds. Our laboratory, field and *in vitro* studies have proven their high efficiency in growing important agricultural, industrial, and floricultural crops. These synthetic plant growth regulators exhibit high growth-regulating activity when used at low non-toxic to human and animal health concentrations ranging from 10^{-5}M to 10^{-8}M. The practical use of synthetic plant growth regulators Ivin, Methyur and Kamethur for intensifying the growth and development of agricultural, industrial, and floricultural crops, increasing their productivity, and improving crop adaptation to stress factors is proposed.

Keywords: plant growth regulators, pyridine, pyrimidine, Ivin, Methyur, Kamethur, plant growth and productivity, agriculture, biotechnology.

Today, there is a great demand for new effective plant growth regulators, which is evidenced by the volume of their sales in the world, which is approximately 1.2 billion dollars USA per year [1]. Currently, synthetic derivatives of pyridine and pyrimidine are the most promising for use as effective and environmentally friendly plant growth regulators, herbicides and fungicides [2, 3]. This review article describes the results of our previously published works [4, 5, 6], in which the effect of synthetic plant growth regulators: Ivin (N-oxide-2,6-dimethylpyridine), Methyur (sodium salt of 6-methyl-2-mercapto-4-hydroxypyrimidine), Kamethur (potassium salt of 6-methyl-2-mercapto-4-hydroxypyrimidine) on plant growth in field, laboratory and *in vitro* conditions, crop productivity and adaptation to stress factors was studied. Synthetic plant growth regulators have been developed in the Department for Chemistry of Bioactive Nitrogen-Containing Heterocyclic Compounds, V.P. Kukhar Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine.

Global climate change and environmental pollution are negatively impacting growth and reducing yields of one of the world's most important widely grown crops, sunflower (*Helianthus annuus* L.) [7, 8]. The effect of plant growth regulators Ivin, Methyur and Kamethur on growth and productivity of sunflower (*Helianthus annuus* L.) variety Bastion under field conditions was studied in the work [4]. The growth-regulating activity of plant growth regulators Ivin, Methyur and Kamethur was compared with the growth-regulating activity of the auxin IAA (1*H*-Indol-3-yl)acetic acid). It was found that the treatment of seeds before planting in the soil with water solutions of Ivin, Methyur and Kamethur, used at a concentration of 10^{-7}M, contributes to an increase in morphological parameters (length of shoot and root, fresh weight of plant and

basket) of sunflower (*Helianthus annuus* L.) variety Bastion grown in field conditions for 3 months.

The results of the effect of Ivin, Methyur, Kamethur on morphological parameters of sunflower plants are illustrated in Figure 1. The average length of shoot increased: by 8,2603 % - in plants obtained from seeds treated with Ivin, by 6,383 % - in plants obtained from seeds treated with Methyur, by 8,1352 % - in plants obtained from seeds treated with Kamethur, compared to the control (Figure 1, A). The average length of root increased: by 3,2231 % - in plants obtained from seeds treated with Ivin, by 20,5638 % - in plants obtained from seeds treated with Methyur, by 9,259 % - in plants obtained from seeds treated with Kamethur, compared to the control (Figure 1, B). The average fresh weight of plant increased: by 124,1379 % - in plants obtained from seeds treated with Ivin, by 89,6552 % - in plants obtained from seeds treated with Methyur, by 97,0443 % - in plants obtained from seeds treated with Kamethur, compared to the control (Figure 1, C). The average fresh weight of basket increased: by 90,678 % - in plants obtained from seeds treated with Ivin, by 83,8983 % - in plants obtained from seeds treated with Methyur, by 72,8814 % - in plants obtained from seeds treated with Kamethur, compared to the control (Figure 1, D).

The growth-regulating activity of plant growth regulators Ivin, Methyur and Kamethur was higher than the growth-regulating activity of the auxin IAA used at the same concentration of 10^{-7}M. The average length of shoot increased by 0,8761 %, the average length of root increased by 1,33 %, the average fresh weight of plant increased by 46,3054 %, the average fresh weight of baskets by 61,0169 % - in plants obtained from seeds treated with IAA, compared to the control (Figure 1, A, B, C, D).

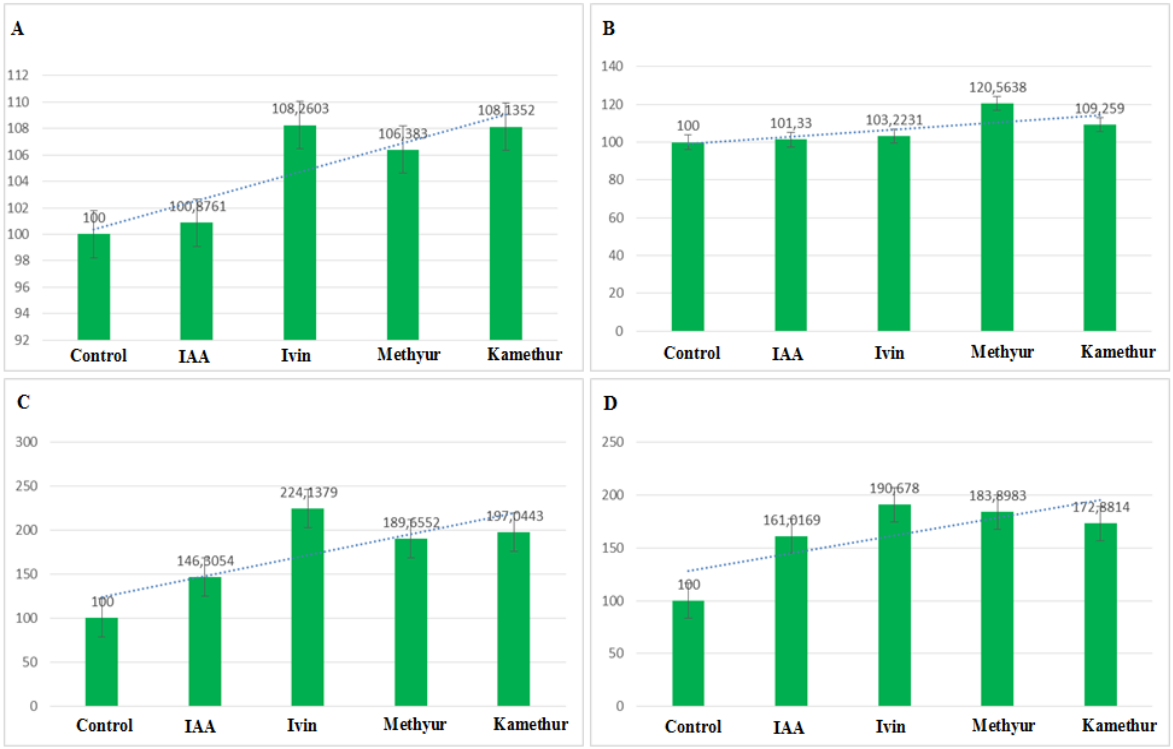

Figure 1. The morphological parameters of sunflower (Helianthus annuus L.) variety Bastion grown for 3 month in field conditions: A - the average length of shoot (%), B - the average length of root (%), C - the average fresh weight of plant (%), D - the average fresh weight of basket (%).

The obtained results suggested that the high growth-regulating activity of Ivin, Methyur and Kamethur is explained by their specific auxin-like stimulating effect on the proliferation, elongation and differentiation of plant cells, which are the main processes of the formation and development of plant shoots and roots, as well on the biosynthesis, metabolism and signaling of endogenous auxins in plant cells [9].

It was found that the treatment of seeds before planting in the soil with water solutions of Ivin, Methyur and Kamethur, used at a concentration of 10^{-7}M, contributes also to an increase in biochemical parameters (content of chlorophylls a and b, and carotenoids) [10] of sunflower (*Helianthus annuus* L.) variety Bastion grown in field conditions for 3 months.

The results of the effect of Ivin, Methyur, Kamethur on biochemical parameters parameters of sunflower plants are illustrated in Figure 2. The content of chlorophyll a increased by 11,1659 % - in plants obtained from seeds treated with Kamethur, compared to the control (Figure 2). The content of chlorophyll b increased: by 47,7819 % - in plants obtained from seeds treated with Ivin, by 62,1236 % - in plants obtained from seeds treated with Methyur, by 60,5887 % - in plants obtained from seeds treated with Kamethur, compared to the control (Figure 2). The content of chlorophylls a+b increased: by 11,8394 % - in plants obtained from seeds treated with Ivin, by 16,468 % - in plants obtained from seeds treated with Methyur, by 25,841 % - in plants obtained from seeds treated with

Kamethur, compared to the control (Figure 2). A comparative analysis showed also that the biochemical parameters (content of chlorophylls and carotenoids) in the leaves of experimental sunflower plants exceeded those of plants obtained from seeds treated with IAA, the content of chlorophyll b increased by 28,2853 %, the content of chlorophylls a+b increased by 4,7939 % - in plants obtained from seeds treated with IAA, compared to the control (Figure 2).

A decrease in content of chlorophyll a was observed in plants obtained from seeds treated with IAA, Ivin and Methyur, and decrease in content of carotenoids was observed in plants obtained from seeds treated with IAA, Ivin, Methyur and Kamethur, compared to the control (Figure 2). It has been suggested that the decrease in the concentration of chlorophyll a and carotenoids is associated with a significant increase in the fresh weight of the plant.

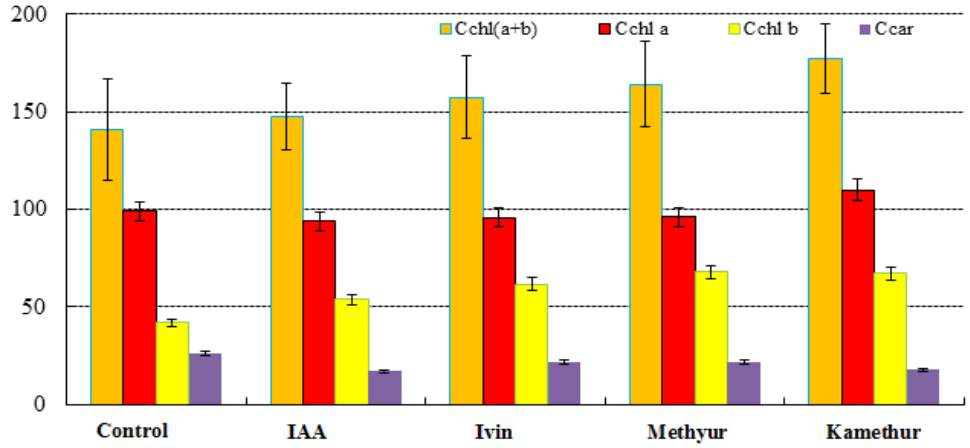

Figure 2.

The biochemical parameters of sunflower (Helianthus annuus L.) variety Bastion grown for 3 month in field conditions: Cchl (a+b) – concentration of chlorophylls a and b (µg/ml), Cchl a – concentration of chlorophyll a (µg/ml), Cchl b – concentration of chlorophyll b (µg/ml), Ccar – concentration of carotenoids (µg/ml).

The obtained results confirmed the possibility of using plant growth regulators Ivin, Methyur or Kamethur in a concentration of 10^{-7}M for the pre-sowing treatment of sunflower (*Helianthus annuus* L.) seeds variety Bastion to increase the length of shoot and root in the vegetative phase, as well as to increase the main indicators of plant productivity - the fresh weight of the plant and basket, and the content of photosynthetic pigments, in particular, chlorophylls b and a+b in plant leaves.

Soil contamination with trace elements (TEs) is a pressing problem limiting the cultivation of agricultural crops; however, the non-food energy crop *Miscanthus* × *giganteus* (*M*×*g*) showing a high biomass yield and immense lignocellulose content can be grown on such soil. The effect of synthetic plant growth regulator Kamethur and polycomponent biostimulant Charkor (based on the complex of synthetic plant growth regulator Ivin with synthetic auxin NAA (1-naphthylacetic acid) and natural biostimulant Emistim C containing secondary metabolites of the root endophyte fungus *Panax Ginsed* M. (i.e. a mixture of amino acids, carbohydrates, fatty acids, polysaccharides, phytohormones, and microelements) was studied when *M*×*g* was cultivated in TE-contaminated soils from Vseborice (former mining) and Chomutov (former military), in the Northern Czech Republic [5].

The results obtained showed that Kamethur contributed to an increase in the biomass of leaves and stems (by 57,1% and 125%, respectively), while Charkor only increased the biomass of leaves (by 49,5%) when *M*×*g* was cultivated in the more polluted soil of Vseborice (Figure 3).

Analysis of the comprehensive bio-concentration index (a predictable indicator to access the ability of phytoagent to accumulate multiple TEs) it was revealed that Charkor increased the accumulation of elements essential for plant development (EEs) in leaves and decreased in stems the potentially toxic (PTEs) elements, by 33,3% and 11,4%, respectively, while Kamethur decreased stem accumulation of EEs by 11,4% and increased the accumulation of PTEs by 23,3%, when *M*×*g* was cultivated in the more contaminated soil from Vseborice.

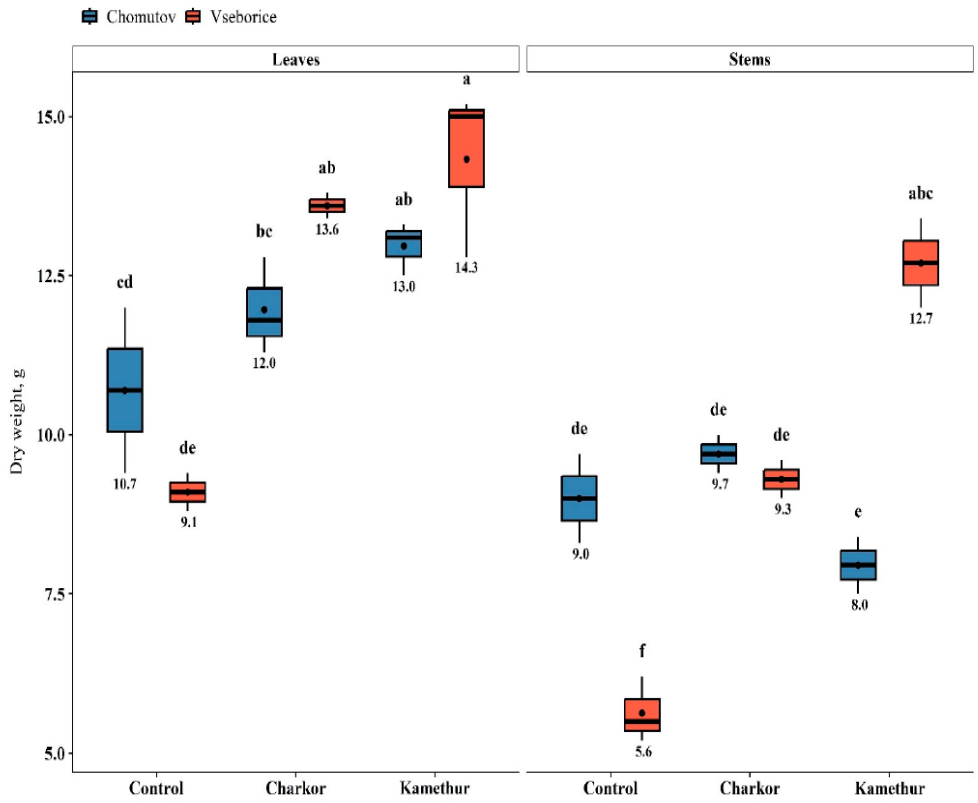

Figure 3. Leaves and stem's DW of M×g grown in the Chomutov and Vseborice soils. Different letters indicate a significant difference between the values ($p < 0.001$).

Statistical evaluation of the current results and literature data illustrated the ability of Charkor to reduce the uptake of PTEs, which is critical for converting clean biomass to bioproducts. It can be recommended for the reduction of PTEs uptake to biomass when the crop is cultivated in varied contaminated soils. Kamethur can be recommended to increase the biomass of leaves and stems when cultivating M×g on various polluted soils. Further research should confirm the influence of Kamethur and Charkor on the bioparameters and phytoremediation processes of *M×g* at the field plantation level.

Rose, belonging to the genus Rosa L. of the Rosaceae family, is a floricultural crop widely used in the horticulture, perfumery, pharmaceutical and food industries [11]. In our work [6], we studied the effect of plant growth regulators Ivin, Methyur and Kamethur on increasing the efficiency of miniature rose (*Rosa mini* L.) organogenesis *in vitro*. The growth regulatory activity of plant growth regulators Ivin, Methyur and Kamethur was compared with the activity of plant hormone auxin IAA. It was shown that the effect of synthetic plant growth regulators Ivin, Methyur and Kamethur used at concentrations of 10^{-5}M, 10^{-6}M, 10^{-7}M per 1 liter of MS (Murashige and Skoog) medium on the organogenesis of shoots and roots of miniature rose (*Rosa mini* L.) *in vitro* is similar or higher than the effect of the plant hormone auxin IAA used at the same concentrations. The synthetic plant growth regulators showed the highest effect on the organogenesis of shoots and roots of miniature rose (*Rosa mini* L.) *in vitro* when used in concentrations: Ivin at concentrations of 10^{-5}M and 10^{-6}M, Kamethur at concentrations of 10^{-5}M and 10^{-6}M, Methyur at concentrations of 10^{-5}M and 10^{-7}M (Figure 4, A and B). The plant hormone auxin IAA showed the highest effect on the organogenesis of shoots and roots of miniature rose (*Rosa mini* L.) *in vitro* when used as component of the MS medium at concentrations of 10^{-6}M and 10^{-7}M (Figure 4, A and B).

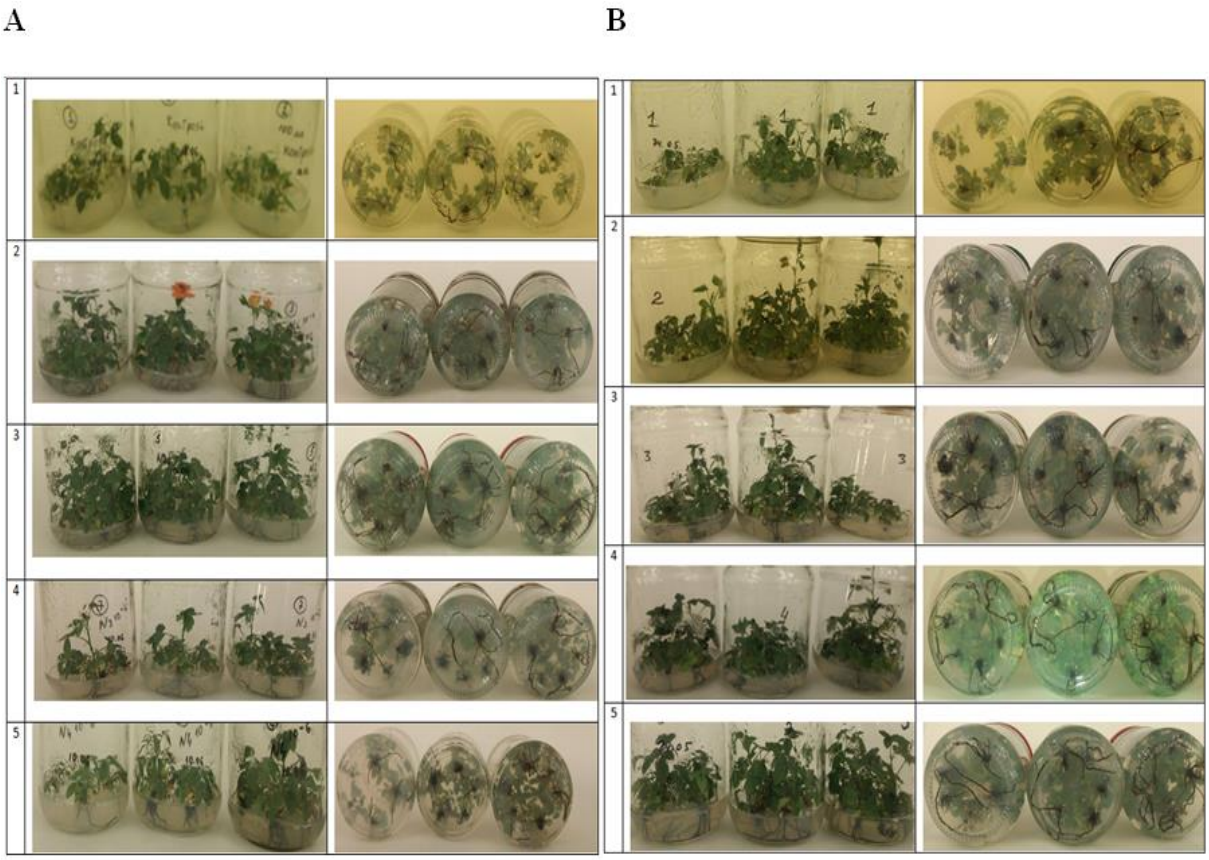

Figure 4. Organogenesis of shoots and roots of miniature rose (Rosa mini L.) in vitro, measured on the 28th day of cultivation, (A): 1- control hormone-free MS medium, 2 - MS medium containing Ivin at a concentration of 10-6M, 3 - MS medium containing Kamethur at a concentration of 10-6M, 4 - MS medium containing Methyur at a concentration of 10-6M, 5 - MS medium containing plant hormone auxin IAA at a concentration of 10-6M; (B): 1- control hormone-free MS medium, 2 - MS medium containing Ivin at a concentration of 10-7M, 3 - MS medium containing Kamethur at a concentration of 10-7M, 4 - MS medium containing Methyur at a concentration of 10-7M, 5 - MS medium containing plant hormone auxin IAA at a concentration of 10-7M

According to the parameters of length of shoots (cm) per explant, measured on the 21st and 28th days of cultivation, synthetic plant growth regulators showed the highest activity: Ivin at concentration of 10^{-6}M (1,75±0,12 cm and 2,82±0,19 cm), Kamethur at concentrations of 10^{-5}M (2,1±0,37 cm and 2,75±0,28 cm) and 10^{-6}M (1,8±0,24 cm and 2,87±0,17 cm), and Methyur at concentrations of 10^{-5}M (2,8±0,24 cm and 2,75±0,63 cm) and10^{-7}M (3,42±0,95 cm and 3,92±0,64 cm), respectively, compared with lower parameters of length of shoots (cm) per explant obtained on the control hormone-free medium MS (1,0±0,57 cm and 2,17±0,33 cm). According to the parameters of length of roots (cm) per explant, measured on the 21st and 28th days of cultivation, synthetic plant growth regulator showed the highest activity: Kamethur at concentrations of 10^{-5}M (2,75±0,28 cm and 2,83±0,33 cm), 10^{-6}M (2,08±0,39 cm and 3,15±0,33 cm) and 10^{-7}M (1,55±0,44cm and 2,83±0,21cm), respectively, compared with lower parameters of length of roots (cm) per explant obtained on the control hormone-free medium MS (1,17±0,7 cm and 2,0±0,57 cm). According to the parameters of number of roots (pcs) per explant, measured on the 21st and 28th days of cultivation, synthetic plant growth regulators showed the highest activity: Ivin at concentrations of 10^{-5}M (6,0±1,39 pcs and 6,33±1,30 pcs) and 10^{-6}M (6,16±1,37 pcs and 6,33±1,3 pcs), Kamethur at concentrations of 10^{-5}M (5,8±1,13 pcs and 6,6±1,47 pcs), 10^{-6}M (6,33±1,19 pcs and 7,83±2,11pcs) and 10^{-7}M (5,88±1,28 pcs and 6,19±1,32 pcs), Methyur at concentrations of 10^{-5}M (7,5±1,49 pcs and 7,92±2,73 pcs) and 10^{-6}M (5,95±1,25 pcs and 6,65±1,5 pcs), respectively, compared with lower parameters of number of roots (pcs) per explant obtained on the control hormone-free medium MS (3,0±1,39 pcs and 3,5±1,27 pcs). According to the parameters of the frequency (%) of shoot rooting, measured on the 21st and 28th days of cultivation, synthetic plant growth regulators showed the highest activity: Ivin at concentrations of 10^{-5}M (67,75±0,93 % and 67,8±4,18 %) and 10^{-6}M (80,17±2,74 % and 80,83±3,05 %), Kamethur at concentrations of 10^{-5}M (67,2±4,12 % and 73,75±3,69 %), 10^{-6}M (73,67±2,51% and 99,83±0,33 %) and 10^{-7}M (60,67±2,61 % and 67,17±1,85 %), Methyur at concentrations of 10^{-5}M (87,75±3,24 % and 87,33±5,10 %) and 10^{-7}M (80,33±2,51 % and 87,5±1,41%), respectively, compared with lower parameters of the frequency (%) of shoot rooting obtained on the control hormone-free medium MS (39,33±7,99 % and 53,17±4,84 %).

The plant hormone auxin IAA showed the highest activity in relation to the parameters of shoot and root organogenesis, measured on the 21st and 28th days of cultivation, according to the length of shoots (cm) per

explant at concentrations of 10^{-7}M (2,85±0,77 cm and 2,93±0,32 cm) and for the frequency (%) of shoot rooting at concentrations of 10^{-6}M (60,33±1,4 % and 80,16±2,74 %) and 10^{-7}M (93,17±1,55 % and 93,17±1,55 %), respectively.

The obtained results showed both cytokinin- and auxin-like effects of plant growth regulators Ivin, Methyur and Kamethur on the processes of elongation, division and differentiation of the isolated plant cells, which are the main processes of organogenesis of shoot and root meristems of miniature rose (*Rosa mini* L.) *in vitro*. The application of plant growth regulators Ivin, Methyur and Kamethur for micropropagation of the miniature rose (*Rosa mini* L.) through *in vitro* culture is proposed.

Acknowledgment. This research was carried out with the support of the project "Development of new plant growth regulators based on azaheterocycle derivatives" (Resolution of the Bureau of the Academy of Sciences of the National Academy of Sciences of Ukraine from June 8, 2021 No. 4. State registration No 0122U000442, code: 2.1.10.12-22. Decision of the Expert Council on Evaluation of Topics of Fundamental Research Works at the National Academy of Sciences of Ukraine from 07.07.2021 No. 2), and with the support of the Czech-German project "Miscan-Value-Cornet" (Reg. No. CZ.01.1.02/0.0/0.0/19_263/0018837).

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CHEMICAL SCIENCES

ИЗУЧЕНИЕ ХИМИЧЕСКОГО ВЗАИМОДЕЙСТВИЯ В СИСТЕМЕ Ga-$SrGaSe_2$

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STUDYING CHEMICAL INTERACTION IN THE Ga-$SrGaSe_2$ SYSTEM

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Аннотация

Химическое взаимодействие в системе Ga-$SrGaSe_2$ изучалось с использованием комплексных методов физико-химического анализа: дифференциально-термического анализа (ДТА), рентгеноструктурного анализа (РФА), микроструктурного анализа (МСА), а также определения плотности и микротвердости; была построена Т-х фазовая диаграмма. Фазовая диаграмма системы была частично квазибинарной и сопровождалась эвтектическим равновесием и перитектическим превращением. Со стороны Ga системы образуется вырожденная эвтектика. В системе Ga-$SrGaSe_2$ растворение с обеих сторон не обнаружено.

Abstract

The chemical interaction in the Ga-$SrGaSe_2$ system was studied using complex methods of physicochemical analysis: differential thermal analysis (DTA), X-ray diffraction analysis (XRD), microstructural analysis (MSA), as well as determination of density and microhardness; a T-x phase diagram was constructed. The phase diagram of the system was partially quasi-binary and was accompanied by eutectic equilibrium and peritectic transformation. A degenerate eutectic is formed on the Ga side of the system. In the Ga-$SrGaSe_2$ system, no dissolution was detected on both sides.

Ключевые слова: система, эвтектика, перитектика, плотность, микротвердость.

Keywords: system, eutectic, peritectic, density, microhardness.

Введение

Путем изучения большого количества систем, содержащих галлий и его халькогениды, были получены материалы с функциональными свойствами. В результате химической реакции между соединениями GaSe и SrSe было получено тройное соединение $SrGaSe_2$. Каждый из этих компонентов, составляющих систему, представляет собой полупроводниковый материал с уникальными свойствами. Соединение GaSe и новые фазы твердые растворы, полученные на его основе, являются материалами с высокими фотоэлектрическими [1-9] свойствами. Хотя большое количество систем на основе халькогенидов основных элементов II полугруппы не изучены, но используются для получения материалов с люминесцентными свойствами [10-15].

Цель работы – исследование химического взаимодействия в системе Ga-$SrGaSe_2$ и построение ее фазовой диаграммы. Компоненты системы обладают следующими свойствами.

Ga плавится при 29,8°C и кристаллизуется в ромбической сингонии с параметрами решетки: a=4,516; b=7,645; c=4,511 A, плотность ρ=5,91 [16].

Соединение $SrGaSe_2$ инконгруэнтно плавится при 1010°C и кристаллизуется в тетрагональной сингонии, параметры решетки: a=6,85; c=10,01 Å, z=4, плотность ρ= 4,78 г/$см_3$ [17].

Экспериментальная часть

При синтезе сплавов системы Ga-$SrGaSe_2$ использовались как элементы, так и компоненты Ga и $SrGaSe_2$. Перед синтезом сплавов из компонентов Ga и $SrGaSe_2$ было синтезировано соединение $SrGaSe_2$. Учитывая, что соединение $SrGaSe_2$ имеет перитектическую природу, после синтеза оно было

подвергнуто термообработке в течение 240 часов ниже перитектической температуры на 20°C. Затем из компонентов Ga и $SrGaSe_2$ в кварцевой ампуле с притоком воздуха до давления 0,133 Па были синтезированы сплавы системы Ga-$SrGaSe_2$. Сплавы системы Ga-$GaSe_2$ исследованы методами физико-химического анализа.

Дифференциально-термический анализ (ДТА) проводился с помощью низкочастотного пирометра Курнакова. Скорость нагрева сплавов составляла 10 град/мин. В качестве термопары использовали хромель-алюмель.

Рентгенофазовый анализ сплавов проводили на рентгеновском дифрактометре D2 PHASER. В качестве облучателя использовался CuKα-электрод. Микротвердость измеряли с помощью металлографического микроскопа ПМТ-3. В ходе измерений изучалась зависимость микротвердости от веса.

Микроструктурный анализ (МСА) проводили на микроскопе МИМ-8. Для этого сплавы полировали и придавали блеск, а их структуру наблюдали под микроскопом. Для уточнения фазовых границ использовали раствор 10 мл HCl + 5 мл H_2O_2. Плотность сплавов системы определяли пикнометрическим методом; В качестве наполняющего раствора использовался толуол.

Результаты и их обсуждение

Сплавы системы Ga-$SrGaSe_2$ представляют собой твердые вещества их цвет меяется от серебристого до черного. Образцы подвергались термической обработке при температуре 700°C в течение 100 часов.

Результат дифференциально-термического анализа показывает, что на термограммах сплавов наблюдаются три эндотермических эффекта. Большое количество эффектов в системе свидетельствует о том, что происходит ряд химических процессов.

Результаты анализа микроструктуры показывают, что все сплавы системы Ga-$SrGaSe_2$ являются двухфазными. Поскольку соединение $SrGaSe_2$ является перитектическим, выше 1010°C оно разлагается следующим образом:

$$SrGaSe_2 \leftrightarrow Ж + SrSe$$

В результате распада соединения $SrGaSe_2$ между кривой ликвидуса и линией солидуса образуется трехфазное поле, состоящее из (Ж+SrSe+$SrGaSe_2$). Установлено, что система Ga-$SrGaSe_2$ частично квазибинарна. В результате перитектического превращения при низкой температуре ниже линии солидуса Ж+SrSe↔$SrGaSe_2$ происходит кристаллизация двухфазных (Ga+$SrGaSe_2$) сплавов.

Для уточнения результатов дифференциально-термического анализа (ДТА) и микроструктурного анализа был проведен рентгенофазовый анализ сплавов системы. Сплавы, содержащие 30 и 70 мол. % $SrGaSe_2$ исследовали методом рентгенофазового анализа. Дифрактограммы систем сплавов, содержащих 30 и 70 мол. % $CaGaSe_2$, сравнивались с дифрактограммами исходных компонентов.

Как видно из рисунка 2, дифракционные линии на дифрактограммах сплавов состоят из смеси дифракционных линий основных компонентов. Это говорит о том, что система является трехфазной при более высоких температурах, но двухфазной при более низких температурах, т.е. система является квазибинарной.

Наконец, результаты дифференциального термического и микроструктурного анализов были подтверждены рентгеноструктурным анализом.

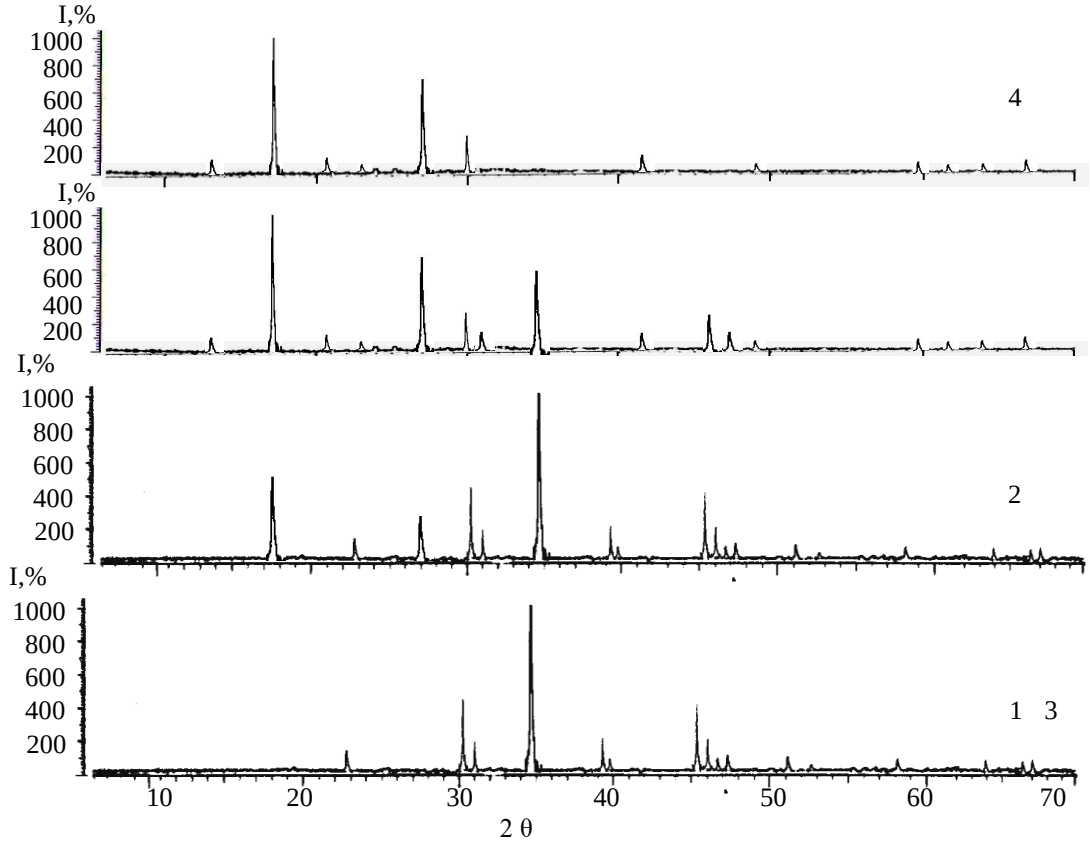

Рис. 1. Дифрактограммы сплавов системы Ga-SrGaSe₂.

1-Ga, 2-30 mol %, 3- 70 mol %, 4-100 mol % $SrGaSe_2$.

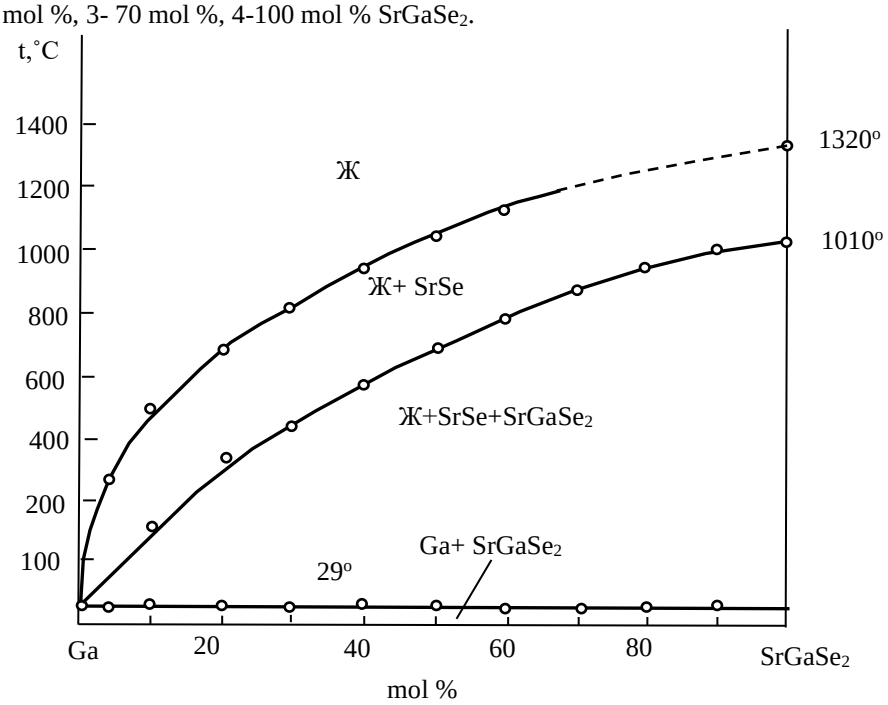

Рис. 2. T-x фазовая диаграммы системы Ga-SrGaSe₂.

Фазовая диаграмма T-x системы Ga-$SrGaSe_2$ построена на основе результатов физико-химических методов анализа (рис. 3).

Ликвидус системы Ga-$SrGaSe_2$ ограничен моновариантной кривой равновесия, состоящей из Ж↔SrSe, образующейся в результате распада соединения $SrGaSe_2$. Ниже кривой ликвидуса располагаются трехфазные сплавы, состоящие из (Ж+SrSe+$SrGaSe_2$) в диапазоне 0-100 мол. % $SrGaSe_2$. В системе Ga-$SrGaSe_2$ со стороны галлия образуется вырожденная эвтектика. В результате перитектического превращения в системе ниже линии солидуса происходит кристаллизация двухфазных сплавов, состоящих из ($CaGaSe_2$ + Ga) переходящие в Ж + SrSe ↔ $SrGaSe_2$. Некоторые физико-химические свойства сплавов системы Ga-$SrGaSe_2$ приведены в таблице 1.

Таблица 1.

Состав сплавов системы Ga-$SrGaSe_2$, результаты ДТА, измерений плотности и микротвердости

Состав, мол. %		Термические эффекты, °С	Плотность, г/см^3	Микротвердость, МПа	
Ga	$SrGaSe_2$			Ga	$SrGaSe_2$
				P=0,05 Н	P=0,15Н
100	0,0	29,8	5,91	700	–
95	5,0	29,230	5,83	700	–
90	10	29,150,490	5,81	700	–
80	20	29,320,690	5,69	700	–
70	30	29,440,820	5,57	–	1145
60	40	29,560,945	5,46	–	1145
50	50	29,680,1040	5,34	–	1145
40	60	29,780,1140	5,23	–	1145
30	70	29,880	5,12	–	1145
20	80	29,940	5,00	–	1145
10	90	29,1000	4,89	–	1145
0,0	100	1010,1320	4,78	–	1145

Заключение

Таким образом, исследовано химическое взаимодействие в системе Ga-$CaGaSe_2$ и построена фазовая диаграмма Тх. Диаграмма состояния системы частично квазибинарна. Область твердого раствора в системе практически не определяется исходными компонентами. В системе происходит перитектическое превращение по реакции Ж+SrSe ↔ $SrGaSe_2$. Со стороны Ga образуется вырожденная эвтектика.

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ECONOMIC SCIENCES

O'ZBEKISTONNING TOG'LI VA TOG'LI HUDUDLARIDA YONG'OQNING QIMMAT ZANJIRI TAHLILI

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ANALYSIS OF VALUE CHAIN OF WALNUT IN MOUNTAIN AND SUB-MOUNTAIN AREAS OF UZBEKISTAN

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DOI: 10.5281/zenodo.10132212

Annotatsiya

Maqolada tog‘ va tog‘oldi hududlarida yong‘oq yetishtirish va sotish qiymat zanjirida yakuniy narx shakllanishi bo‘yicha xarajatlar ulushi tahlili natijalari keltirilgan. Izlanish natijalariga ko‘ra dehqonlar tomonidan olingan sof qiymat, yong‘oq mag‘izlarini an’anaviy vositachilardan farqli o‘laroq, takomillashgan kanal ichidagi qayta ishlovchilar orqali sotilganlarida sezilarli o‘sishni ko‘rsatadi.

Abstract

This study shows the results of the cost share analysis of the final price formation in the value chain of walnut production and sale in mountain and sub-mountain regions in uzbekistan. Results revealed that net price received by the farmers shows a significant increase when the walnut kernels are sold through improved in-channel processors as opposed to traditional intermediaries.

Kalit so‘zlar: Yong'oq, dehqon, qiymat zanjiri, sotuvchi, sotuv samaradorligi, qayta ishlovchi, marketing samaradorligi,eksport.

Keywords: walnut, farmer, value chain, trader, marketing margin, processor, marketing efficiency, export.

INTRODUCTION

The post-harvest losses in this fruit are significant in terms of quantity and resultant economic value. The concept of placing emphasis on increased production of fruits is self-defeating. It is important to see how the produce goes through processing and finally reaches the export market. Efforts should be made to integrate production with post-harvest management to improve its availability by reducing its losses[1]. Walnut (Juglans regia) production in Uzbekistan is one of the important horticultural products being exported to almost 50 countries generating nearly 30 thousand metric tonnes annually. Walnut, the second most important nut, is found in areas with more moisture either in pure walnut forests or mixed with fruit trees. There are 30 traditional walnut varieties native to Uzbekistan. Walnut forests supply approximately 90 tons of walnuts each year. Although they are only harvested for one month, they contribute greatly to the annual income of rural communities. In 2020, farmers could sell walnuts for a price of US$2 per kg. [2]

Walnut holds a good place in trade owing to its high demand in national and international market. However, the poor marketing system has deprived growers from the benefits that actually should accrue to them. Processing of this fruits at farm level could be an option for such problems but inadequate and unscientific processing resulted in qualitative loss, which is more serious and can infected the produce unsuitable for human consumption[3].

Although number of references relating to estimation of post-harvest losses and value addition in several fruits are available in literature [4], a very little work has been done regarding walnut in Uzbekistan. Realizing the economic importance of walnut, this paper investigated into the analysis of losses, and modernized value chain of walnut in several regions of uzbekistan.

MATERIALS AND METHODS

This study was based on the data collected through questionnaires conducted in 2023 from walnut farmers in five districts of Samarkand region - Urgut, Ishtikhan, Oqdaryo, Kushrabot, Payariq and Forish district of Jizzakh region.

RESULTS AND DISCUSSION

In the mountainous and sub-mountainous regions of Uzbekistan, the walnut value chain consists of the following links:

1. Cultivation: Walnut cultivation in these regions is often carried out in places with suitable climate and soil conditions. Farmers plant walnut seedlings, carry out necessary care such as watering, fertilizing, pest control. Terraced farming methods can be used to optimize land use in mountainous areas.

2. Harvesting: Walnut harvesting in the region usually begins on August 20, when the walnuts are fully ripe in the fall. Traditionally, manual harvesting methods are used, with workers climbing trees to shake branches or using long sticks to tap the nuts. Ripe nuts are picked and prepared for further processing. Early harvesting of walnuts, between August 20 and 30, allows obtaining high-value light-colored kernels, but also increases the percentage of low-value "puchak" kernels.

3. Post-harvest processing: Post-harvest processing includes shelling, washing and drying of the walnuts. In mountainous areas, traditional methods of

debarking can be used, such as using wooden mallets or stone mills to remove the green outer casing. Drying is usually done naturally, by drying in the sun or using well-ventilated drying rooms.

4. Preparation: In mountainous and semi-mountainous areas, walnut preparation may involve local merchants or middlemen who collect walnuts from farmers and transport them to their markets. Transportation methods may include trucks or other vehicles suitable for use in mountainous terrain.

5. Processing: after drying, the walnuts are processed to separate them from the husks (bites). Depending on the size and available equipment, this can be done manually or with the help of mechanical grinding machines. This part is usually not done by the farmers, but by the preparers with the help of hired workers.

6. Packaging: After the walnuts are processed, they are packaged for storage, transportation and distribution. Packaging materials can vary, but commonly used options include cardboard boxes or plastic containers. The packaging is designed to protect the walnut from damage and preserve its quality during transportation.

7. Retail: At the retail level, walnuts from the mountainous regions of Uzbekistan can be sold at local farmers' markets. These outlets serve both local consumers and tourists interested in purchasing local products. In addition, attention can be paid to promoting the unique qualities and origin of mountain walnuts to attract buyers.

8. Export. When exporting walnuts from Uzbekistan, several general requirements are usually applied:

- Quality standards: Products intended for export must meet international trade regulations and quality standards set by the importing country. Nuts must be of good quality, free from pests, diseases and contaminants.
- Packaging and labelling: Walnuts for export must be properly packed and labeled in accordance with international standards and established national requirements. Proper packaging helps protect nuts during shipping and keeps them fresh.
- Phytosanitary certificate: Many countries require a phytosanitary certificate to ensure that exported walnuts are free from harmful pests and diseases.
- Export license and documentation: Exporters must obtain the necessary export license and complete all documentation requirements according to the country's export regulations. This includes invoices, customs declarations, certificates of origin and additional documents requested by the importing country.
- Trade agreements and tariffs: If there is any trade agreement between Uzbekistan and the importing country, special tariff rates or preferential trade conditions affecting the export process may be applied.

Currently, the commodity characteristics (consumer value) of walnuts in the world market are evaluated by the following indicators:

- Taste quality of walnut kernel
- Color of walnut core
- An indicator of the size of the kernel of walnut
- The thickness of a walnut shell
- Ease of separating the kernel from the shell

According to Inobatov [5], walnuts are offered to the Russian market in the following categories, depending on the size of the kernel:

1. **Halves**. The kernel of the walnut is divided into two equal parts and looks like a butterfly. It is consumed directly as a ready-made food product. This category includes walnuts, 80% of which are halves, as well as a kernel the size of three-quarters of a halves, the rest of the mass consists of quarters.

2. **Quarters.** These are pieces of the kernel that have not been sifted into a sieve with round holes and a diameter of 11 mm. The walnut kernel is divided into four equal parts. It is eaten directly and added to various dishes and salads

3. **Eights, small pieces of kernel.** This discharge of the kernel consists of pieces that have passed through a sieve with round holes and a diameter of 11 mm, but at the same time not sifted into a sieve with a diameter of 3 mm. Eights are usually divided into two sizes: 3-6 mm and 7-10 mm. These pieces of walnut are used in confectionery and baking.

4. **Crumbs.** These are tiny pieces of the walnut kernel, the size of which does not exceed 3 mm. The crumb is used in the confectionery craft, namely: it is added to the dough, ice cream, cakes, pastries are sprinkled, and walnut fillers are prepared from the crumb.

5. ***Walnut flour.*** The smallest part of the nut kernel that has passed through a sieve. It is added to the dough and used to prepare cakes, various pastries and nut cream.

Products in each category are sold for a specific purpose based on market demand, and the product price is formed accordingly. There is a significant difference in grades between categories. Also, the products of the first and second (mainly the first) categories are sold at different prices depending on the color of the kernel.

Table 1

Classification of walnut kernels in the local market in Uzbekistan according to color and shape

Kernel class	Description	Color	Average purchase price (2022, thousand soums)
G‘ilak	Mainly aimed at domestic consumption	White	65
		Brown	58
		Red	43
Kapalak	Intended for export and partly for domestic consumption.	White	55
		Brown	51
		Mixed	46
		Red	45
Sechka	As a raw material for confectionery products	Brown	26
		Mixed	26
		Red	26
		Black	26
Puchak	As a raw material for confectionery products	Brown	21
		Mixed	21
		Red	21
		Black	21

Table 2

Classification of unshelled walnuts for export by size

Grade name	**Code**	**Nut size**
Apple	111	33-38 mm
Pear	555	30-33 mm
Cherry	999	27-30 mm

According to the international classification, walnut kernels are divided into the following types:

1. Extra light half	1st
2. Light halves	Second
3. Light broken	Third
4. Light amber halves	Fourth
5. Light amber broken	Fifth

During the research, questionnaires were conducted among walnut growers in Urgut, Ishtikhan, Oghdarya, Kushrabot, Payariq districts of Samarkand region and Farish district of Jizzakh region. All costs and revenues in the analysis are calculated relative to the processors' purchase prices. The pattern of use of walnut by surveyed farmers showed that the weight of commodity products is 92.39 percent of the gross walnut production of each farm. Losses make up 7.52% of the total nut production. Only 1.3 percent of the gross nut production was saved for family consumption.

Table 3

Realization of walnut harvest in the surveyed farms

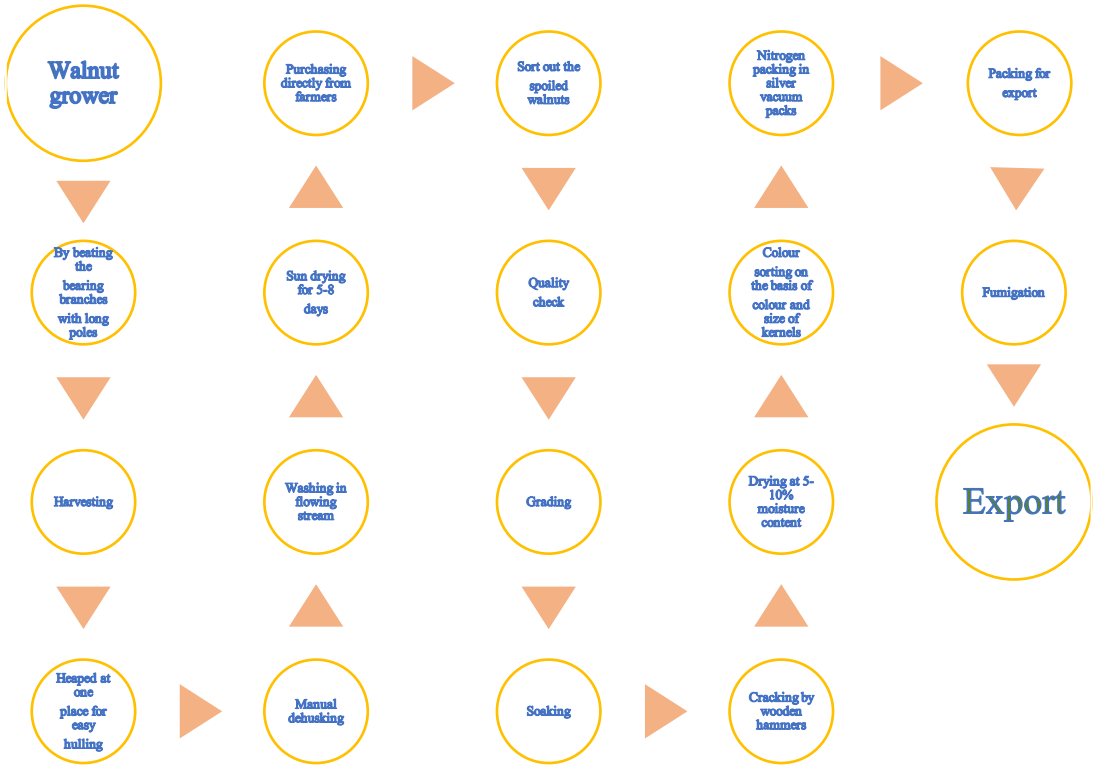
Indicators	Quantity, tons	% of total
Total product	1740	100,00
Losses	130,8	7,52
Consumption	22,6	1,30
Marketable surplus	1586,5	91,18

Producers in the study area used two channels to sell their products:

1st channel: Farmer → Trader → Processor → Export

2nd channel: Farmer → Processor → Export

The practice of selling small quantities of unshelled walnuts at local farmers' markets was also observed. When the product is delivered through the traditional channel, farmers sell their produce in the form of unshelled walnuts to middlemen who go door-to-door in villages. They, in turn, sell the product to the processors, either in a cracked or cracked form. In the improved channel, farmers sell their products directly to the processor. Adding value to products and processing plays a major role in the walnut value chain. Improving this chain is important in adding value to it and distributing it equally across all links of the production and supply chain.



1- picture. Walnut supply chain.

Capital Formation and Investment Pattern

Most of the walnut growers in Uzbekistan belong to the category of peasant farms operating in remote areas and working in the market with a small profit. At the same time, value addition for the export of walnuts requires a large amount of technical equipment and manpower.

Many private enterprises have invested in walnut processing, and they spend a lot of money on fixed and working capital to produce products for the foreign market [6]. As can be seen from table 4, investments in buildings occupy a high weight in the formation of total capital. The most important objects of investment by weight are conveyor belts (14.93%), followed by dryers (3.45%), boxes (3.54%) and core graders (1.74%). This capital stock requires regular technical service and repair.

Table 4

Capital formation at private walnut enterprises

Capital formation	**Quantity (pcs)**	**Value (thousand soums)**	**% of total value**
Working capital			
Boxes	2530	106638	3,54
Buckets	755	25271	0,84
Washing tubs	65	2916	0,1
Others (hammers, washing baskets, etc.)	672	3610	0,12
Sub-total (a)	**4022**	**138574**	4,60
Medium-term capital		0	
Tractor/load carrier	0,5	20411	0,68
Vacuum packers	2	37073	1,23
Semi vacuum packer	0,5	15551	0,52
Walnut grader	1	32630	1,08
Kernel grader	2	52486	1,74
Transformer (stabilizer)	1	21661	0,72
Tray dryers	6,5	106638	3,54
Conveyer belts	3	449880	14,93
Blowers	1,5	5554	0,19
Strapping machine	1,5	16246	0,54
Taping machine	1,5	5554	0,19
Other (trollies, sealers and hand graders)	4,5	5276	0,18
Sub-total (b)	**25,5**	**769240**	25,52
Long term capital		0	
Land / buildings	4	2082780	69,1
Washing tanks	4	23327	0,77
Sub-total (c)	—	2106107	69,88
Total(a+b+c)	**4051,5**	**3013922**	100

Several raw material delivers from walnut growers in different districts, while one processing company was found to have established its own walnut plantation. The total purchase of walnuts and kernels ranged from 1000-3000 to 2500-3500 centners. Although the main part of walnuts was purchased from Forish (23%), followed by Ishtikhan (20%), Urgut (18%), Akdarya (10%) and others (29%), the largest amount of walnut kernels share (42%) was prepared from Ishtikhon district and Akdarya district (30%). As for value-added walnut exports, most of the product was exported through agents. 47 percent of the product was exported directly to other walnut importing countries, mainly in the form of kernels.

The nut supply chain is shown in Figure 1. The fruits are mostly harvested when the tree begins to split its bark and some nuts begin to fall naturally. Harvesting begins on August 15-20 in the climatic conditions of Uzbekistan, and on September 10-15 in mountain and sub-mountain regions.

A common harvesting practice is to beat the bearing branches with long sticks. The harvest is usually collected by women and children. When the crop is knocked down, 50-60% of the peel is removed if the nut crop is ripe, and 2-3% of the peel is removed if the crop is raw. The harvested crop is spread out in a shady and windy place for ethylene synthesis and stored for 3-4 days to separate the husk. It is quickly and qualitatively peeled by hand. Nowadays, due to the development of technology, this work can be done using machines, but in this way, the quality of the crop is damaged. Bleaching of the nuts is also used to some extent in some regions. In this case, the crop is harvested before it is ripe, the harvested crop is separated from the husk within 2-3 days and dried in a place away from the wind and sunlight. But in this process, the raw product loses up to 30% weight in 24 hours. The nut crop is dried in open conditions and may take 3-5 days to dry depending on favorable weather conditions.

Processing entrepreneurs organize the collection of products from nut growers in different regions, in the process of buying walnuts from farmers, they are priced according to the moisture level of the nuts, the color of the kernel, the thickness and thinness of the shell, and the type of color. Dried walnuts are packed and stored in a place where there is no sunlight. If it is not free from sunlight, it will negatively affect the quality of the crop and lead to a decrease in the value of the product. Private enterprises purchase raw materials directly from farmers with partial or full advance payment.

It was observed that the studied walnut farmers preferred to sell the product to processing enterprises. Quick payments and high prices have led to farmers making good profits by bypassing middlemen.

After the product is brought and unloaded by the farmer or the entrepreneur in the processing plants, the product is subjected to quality control. Walnut size, kernel percentage and shell thickness as well as nut moisture, color, flavor are used to determine price and add value. Then the walnuts are graded by size using a grader. It is desirable to obtain full-sized kernels; walnuts are soaked in washing tanks for 6-10 hours for removing dirt, other contamination and for easy cracking. Soaked walnuts are then cracked by skilled female workers with the help of wooden hammers and steel coils. Skilled women labours are engaged for cracking nuts so as to avoid breakage of kernels. About 37-40 kg of kernels are obtained from 100 kg of nuts depending upon shell thickness and quality of nuts. After extraction from the nuts, the kernels are dried in tray dryers and 5-10% moisture is kept inside the kernel. Then kernels undergo grading by kernel graders depending upon size. The graded produce is then placed over conveyor belts and skilled labour sort them out on the basis of kernel colour into five grades as per Table 2. During summers, in lean season, kernels are preserved with nitrogen and packed in vacuum silver packs to get over unfavourable climatic conditions. After this, the produce is prepared for final packing during peak season. Summer packs are opened and finally packed into plastic packs of varying size. Packed material is then put into corrugated boxes. Packed material is then put into corrugated boxes. The containers are fumigated with methyl Bromide to prevent any access of fungus inside it.

The exporter must obtain another certificate confirming that the fumigation has been carried out in accordance with the prescribed standards and that the fumigation has been carried out in the container and not before varnishing, painting or wrapping[7]. The packaged nut kernels are then exported to various trading partners.

Value addition for export when procured as nut and exported as kernel by processor.

Under the conditions of Uzbekistan, within these channels, walnut processing enterprises purchase walnuts from merchants or directly from local farmers. Processors compensate these suppliers in the form of prices based on the quality of the walnuts. In determining the price of the harvested product, processors classify purchased nuts into three distinct varieties (Table 2). Processors devote considerable resources to increasing the value of walnuts and then releasing them to the global export market in the form of different kernel varieties. Although processor categorize kernel into 5 grades, however, price spread for grade viz. Light halves, Light broken, and Light amber halves has been averaged and presented in Table 5. It is noteworthy that when farmers are able to sell their products directly to processors, their net income increases significantly. In addition, all intermediaries involved in this direct sales channel prior to the processor have improved profit margins compared to traditional sales channels. Although proportional costs and revenues are relatively high for recyclers, their profit margins remain the highest. This suggests that each unit of value-added investment serves as a proxy for quality improvement in the value-added process[8]. In addition, the distribution of various cost components invested by processing enterprises shows that most of the costs are directed to fixed capital and export of products to international markets.

Table 5

Distribution of the price of kernels purchased in the form of unshelled nuts in sales channels by value chain links

	Grade- I		Grade- II		Grade- III					
	Channell-I	%	Channell-II	%	Channell-I	%	Channell-II	%	Channell-I	%	Channell-II	%
Farmer's level												
Harvesting charge	466	0,58	466	0,58	403	0,6	403	0,6	261	0,65	261	0,65
Assembling charge	104	0,13	104	0,13	87	0,13	87	0,13	56	0,14	56	0,14
Dehulling	56	0,07	56	0,07	54	0,08	54	0,08	32	0,08	32	0,08
Cost of weight loss	128	0,16	128	0,16	114	0,17	114	0,17	72	0,18	72	0,18
Drying charge	72	0,09	72	0,09	67	0,1	67	0,1	44	0,11	44	0,11
Packing charge	48	0,06	48	0,06	40	0,06	40	0,06	28	0,07	28	0,07
Local charge	32	0,04	32	0,04	27	0,04	27	0,04	16	0,04	16	0,04
Transport charge	0	0	88	0,11	0	0	74	0,11	0	0	48	0,12
Miscellaneous charges	16	0,02	16	0,02	13	0,02	13	0,02	8	0,02	8	0,02
Total cost	923	1,15	1012	1,26	798	1,19	872	1,3	518	1,29	570	1,42
Loss	104	0,13	177	0,22	87	0,13	154	0,23	56	0,14	100	0,25
Sale price	9066	11,29	17473	21,76	7844	11,69	15118	22,53	5123	12,76	9873	24,59
Net price	8046	10,02	16285	20,28	6958	10,37	14091	21	4545	11,32	9202	22,92
Trader's level												
Purchasing price	9066	11,29	— —		7844	11,69	— —		5123	12,76	— —	
Collection from various places	24	0,03	— —		20	0,03	— —		16	0,04	— —	
Loading and unloading	8	0,01	— —		7	0,01	— —		4	0,01	— —	
Transport charge	88	0,11	— —		74	0,11	— —		48	0,12	— —	
Total cost	112	0,14	— —		101	0,15	— —		64	0,16	— —	
Loss	128	0,16	— —		107	0,16	— —		72	0,18	— —	
Sale price of nut	17827	22,2	— —		15420	22,98	— —		10074	25,09	— —	
Margin	8520	10,61	— —		7368	10,98	— —		4814	11,99	— —	
Processor's level												
Purchase price	17827	22,2	17473	21,76	15420	22,98	15118	22,53	10074	25,09	9873	24,59
Assembling from growers	48	0,06	48	0,06	40	0,06	40	0,06	28	0,07	28	0,07
Loading	8	0,01	8	0,01	7	0,01	7	0,01	4	0,01	4	0,01
Unloading	8	0,01	8	0,01	7	0,01	7	0,01	4	0,01	4	0,01
Quality check	8	0,01	8	0,01	7	0,01	7	0,01	4	0,01	4	0,01
Walnut grading	16	0,02	16	0,02	13	0,02	13	0,02	8	0,02	8	0,02
Soaking	16	0,02	16	0,02	13	0,02	13	0,02	8	0,02	8	0,02
Cracking	56	0,07	56	0,07	47	0,07	47	0,07	32	0,08	32	0,08
Cost of conversion	241	0,3	241	0,3	208	0,31	208	0,31	137	0,34	137	0,34
Drying of kernel	8	0,01	8	0,01	7	0,01	7	0,01	4	0,01	4	0,01
Mechanical grading of kernel	8	0,01	8	0,01	7	0,01	7	0,01	4	0,01	4	0,01
Colour sorting	169	0,21	169	0,21	148	0,22	148	0,22	96	0,24	96	0,24
Packing	233	0,29	233	0,29	201	0,3	201	0,3	132	0,33	132	0,33
Carton	145	0,18	145	0,18	127	0,19	127	0,19	80	0,2	80	0,2
Aluminium foil	96	0,12	96	0,12	87	0,13	87	0,13	56	0,14	56	0,14
Tape	48	0,06	48	0,06	40	0,06	40	0,06	24	0,06	24	0,06
Fumigation of container	8	0,01	8	0,01	7	0,01	7	0,01	4	0,01	4	0,01
Delivery to airport/station	273	0,34	273	0,34	235	0,35	235	0,35	153	0,38	153	0,38
Delivery to import country	554	0,69	554	0,69	476	0,71	476	0,71	313	0,78	313	0,78
Export costs	48	0,06	48	0,06	40	0,06	40	0,06	24	0,06	24	0,06
Miscellaneous charges	32	0,04	32	0,04	27	0,04	27	0,04	16	0,04	16	0,04
Cost of fixed capital	8054	10,03	8054	10,03	6965	10,38	6965	10,38	4549	11,33	4549	11,33
Cost of fixed capital	10062	12,53	10062	12,53	8703	12,97	8703	12,97	5685	14,16	5685	14,16
Loss	1566	1,95	1566	1,95	1208	1,8	1208	1,8	731	1,82	731	1,82
Export price	80300	100	80300	100	67100	100	67100	100	40150	100	40150	100

Value addition for export when procured as kernel and exported by processor

In the modernized channel, the processor appears as one of the important functions between producers and consumers. In this case processor purchased better quality kernels either from trader or directly from farmer. and systematically process them into kernels for international markets based on global demand for kernels.

Net return to farmer was better in channel where he is able to sell his produce to processor directly even when his costs were more. In similar manner, margins of trader were more when he sold walnuts as kernel than nuts. To sum up, net return to farmers were maximum in absolute term in modernized channels. Farmer's returns were relatively more when they sell their produce directly to processor. Further it was observed that farmer per soum invested on value addition added to the dividends of investor. Farmer's net returns were higher in absolute and proportionate terms when they sell kernels directly to the processor. Accordingly, marketing efficiency was found more in channels II when the processor purchase nuts and same results are found in channel II when processor purchase kernels from the producer. The marketing margins were more when processors acted as the main functionaries in the channel.

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Distribution of the price of walnuts purchased in the form of kernels in the sales channels by value chain links

	Grade- I			Grade- II			Grade- III		
	Channel-II	%	Channel-I	Channel-II	%	Channel-I	Channel-II	%	Channel-I	Channel-II	%	Channel-I
Farmer's level												
Harvesting charge	466	0,58	466	0,58	403	0,6	403	0,6	261	0,65	261	0,65
Assembling charge	104	0,13	104	0,13	87	0,13	87	0,13	56	0,14	56	0,14
Dehulling			0									
Cost of weight loss	56	0,07	56	0,07	54	0,08	54	0,08	32	0,08	32	0,08
Drying charge	128	0,16	128	0,16	114	0,17	114	0,17	72	0,18	72	0,18
Local charge	72	0,09	72	0,09	67	0,1	67	0,1	44	0,11	44	0,11
Pre cracking charge	32	0,04	32	0,04	27	0,04	27	0,04	16	0,04	16	0,04
Cracking charge	859	1,07	859	1,07	745	1,11	745	1,11	486	1,21	486	1,21
Cost of conversion	658	0,82	658	0,82	570	0,85	570	0,85	373	0,93	373	0,93
Grading charge	2064	2,57	2064	2,57	1785	2,66	1785	2,66	1168	2,91	1168	2,91
Packing charge	329	0,41	329	0,41	289	0,43	289	0,43	185	0,46	185	0,46
Transport charge	185	0,23	185	0,23	161	0,24	161	0,24	104	0,26	104	0,26
Miscellaneous charges	0	0	185	0,23	0	0	161	0,24	0	0	108	0,27
Loss	16	0,02	16	0,02	13	0,02	13	0,02	8	0,02	8	0,02
Sale price	4111	5,12	4304	5,36	3556	5,3	3724	5,55	2325	5,79	2429	6,05
Net price	891	1,11	1261	1,57	778	1,16	1208	1,8	458	1,14	787	1,96
Traders level												
Purchasing price	35035	43,63			25411	37,87				37,86		
Collection from various places	24	0,03			20	0,03				0,04		
Loading and unloading	8	0,01			7	0,01				0,01		
Transport charge	169	0,21			148	0,22				0,24		
Total cost	201	0,25			174	0,26				0,28		
Loss	490	0,61			436	0,65				1,09		
Sale price	48750	60,71			39978	59,58				60,63		
Margin	13033	16,23			13957	20,8				21,29		
Processor's level												
Purchase price	48750	60,71	48485	60,38	98125	59,58	39804	59,32	24343	60,63	24182	60,23
Assembling from growers	48	0,06	48	0,06	106	0,06	40	0,06	28	0,07	28	0,07
Loading	8	0,01	8	0,01	20	0,01	7	0,01	4	0,01	4	0,01
Unloading	8	0,01	8	0,01	20	0,01	7	0,01	4	0,01	4	0,01
Quality check	8	0,01	8	0,01	20	0,01	7	0,01	4	0,01	4	0,01
Drying of kernel	8	0,01	8	0,01	12,8	0,01	7	0,01	4	0,01	4	0,01
Mechanical grading of kernel	8	0,01	8	0,01	21,23	0,01	7	0,01	4	0,01	4	0,01
Colour sorting	169	0,21	169	0,21	360	0,22	148	0,22	96	0,24	96	0,24
Packing	233	0,29	233	0,29	494	0,3	201	0,3	132	0,33	132	0,33
Carton	145	0,18	145	0,18	305	0,19	127	0,19	80	0,2	80	0,2
Aluminium foil	96	0,12	96	0,12	209	0,13	87	0,13	56	0,14	56	0,14
Tape	48	0,06	48	0,06	96	0,06	40	0,06	24	0,06	24	0,06
Fumigation of container	8	0,01	8	0,01	12	0,01	7	0,01	4	0,01	4	0,01
Delivery to airport/station	273	0,34	273	0,34	572	0,35	235	0,35	153	0,38	153	0,38
Delivery to import country	554	0,69	554	0,69	1173	0,71	476	0,71	313	0,78	313	0,78
Export costs	48	0,06	48	0,06	96	0,06	40	0,06	24	0,06	24	0,06
Misccllancous charges	32	0,04	32	0,04	60	0,04	27	0,04	16	0,04	16	0,04
Cost of fixed capital	8054	10,03	8054	10,03	17100	10,38	6965	10,38	4549	11,33	4549	11,33
Cost of fixed capital	9740	12,13	9740	12,13	20677,03	12,56	8428	12,56	5501	13,7	5501	13,7
Loss	1445	1,8	1445	1,8	3211,45	1,95	1308	1,95	803	2	803	2
Export price	80300	100	80300	100	67100	100	67100	100	40150	100	40150	100

Accordingly, effeciency was higher in channel 2 when the processor purchased unshelled walnuts, and the same results were observed in channel 2 when the processor purchased kernels from the producer.

Net price received by farmer is more when farmer sold kernels through processor in modernized channel rather than other. In modernized channel, more marketing cost was incurred by processor which adds value to the produce and reduces the loss in kernels processing. Despite, more marketing cost in modernized channel processor's margins were seemed to be less which in turn is favourable for the producer to sale its produce through modernized channel. Marketing efficiency was also seen more in case of modernized channel, which emphasized upon the need for grading and scientific manipulation of surplus. Through value addition, integration of walnut production with export marketing would help in harnessing the potential of this crop in domestic and global trade.

The net price earned by farmers shows a significant increase when the walnut kernels are sold through improved in-channel processors as opposed to traditional traders.Through the integration of value addition

and export marketing, the potential of walnut production can be effectively exploited for both domestic and international trade. At the same time, there are a number of problems in the entire process from product preparation to walnut export. Among the problems highlighted by exporters, insufficient supply of raw materials for value addition is a significant problem[9]. Despite the high demand for walnuts in the national and international markets, domestic production is insufficient to meet the demand, which leads to an imbalance between supply and demand. Lack of skilled labor, such as certified specialists and suboptimal export advisory services, as well as the absence of organic certification agencies near production centers, exacerbate the problem. In addition, the high cost of institutional loans and subsidies and the delay in utilization are creating serious problems for private enterprises.

CONCLUSION

Based on the analysis, we can make the following suggestions:

It is necessary to support the organization of training programs for walnut growers and the development of human resources. Most of the activities under "Production Support" do not directly address the nut production system. Although these activities are primarily aimed at increasing the area and productivity of horticultural crops, only a limited number of initiatives are aimed at developing walnut production in the region. Integration of value-added walnut production with export marketing will help use the potential of this crop in domestic and global trade. In addition, improving the quality of research in these areas will be of great benefit.

Special attention to quality improvement will also help to sell nut products at better prices in world markets.

It is necessary to establish small processing units at the producer and regional level. In addition, the government should strengthen various institutions to provide cheap and easy credit to farmers and private nut processors.

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PSYCHOLOGICAL ASPECTS OF THE FORMATION OF THE ACCOUNTING DEPARTMENT AT AGRICULTURAL ENTERPRISES AND ELEMENTS OF ITS AUDIT

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Abstract

The article analyzes the relationships between economic behavior of subjects and their psychological instructions within the framework of accounting. The concept of economic psychology and its development in the world are considered. The main areas of perceived information by accountants through the sense organs were studied. The essence of the vision of the map of the inner world of a person is revealed in accordance with the statement of R. Assagioli. Social responsibility and the Code of Ethics of the accounting profession, which are formed on the basis of such interrelated factors as reliability, professionalism, quality, and trust, were studied.

The types of accounting settings are considered: semantic, target and operational. The processes of motivation of accounting personnel at agricultural enterprises were studied, which made it possible to single out the interests, needs and incentives of employees of the accounting profession and to assert that material stimulation remains the most relevant for employees of the agricultural sector.

The psychological aspects of the accountant's activity from the position of the business owner, who, in addition to qualifications, professional knowledge and skills, also make demands on the personal qualities of the accountant, are singled out. Factors influencing the activity of the accountant, which form the environment of the enterprise (size of the enterprise, psychological features, field of activity, professional knowledge) are analyzed.

An analysis of the provision of quality characteristics of the audit by accountants and its impact on the economic prosperity of the agricultural enterprise in terms of the stay of employees at various stages of their activity was carried out.

It has been proven that the underestimation of the psychological aspects of the activity of accounting employees of the enterprise increases the risk of ineffective decisions in the field of its financial and economic activity.

Keywords: accountant, accounting, audit, personality, economic psychology, motivation, accounting systems, employee's social responsibility.

Introduction. Currently, accounting, using the achievements of other sciences and new technical means to solve the tasks [15, p. 138], undergoes a new stage of its development. His achievements are largely explained by psychological sciences, since it is the person who is the key figure as the spokesperson of accounting thought.

Understanding the influence of psychology on accounting allows us to approach the understanding of the nature of the emergence of various directions in the theory and practice of accounting [8], helps to provide a new understanding of accounting issues and contributes to the improvement of the accounting system.

Review of literature. Today, many scientists deal with the organization of accounting and auditing at the enterprise, namely: Apenko S.N. [1], Butko M.P. [5], Grishnova O.A. [7], Gulya M. [8], Demchenko T.O. [9], Kulynych I.O. [12], Muravsky V.V. [15], Pyatov M.L. [18], Syngaivska I. [20], Turchyn L.E. [22]. Among foreign scientists, we can single out: Assagioli R. [3], Atkinson E. [4], O'Neill O. [16] and others.

Paying tribute to the value of the results obtained by the above-mentioned authors, I would like to note that the question of the psychological influence of various factors on the accounting processes of the enterprise, which are formed by the human behavior of accountants, remains unresolved.

The purpose of the article. The study of connections between the economic behavior of subjects (persons, enterprises, social groups) and their instructions within the framework of accounting, taking into account psychology, which is the basis for the interpretation of important aspects of human professional behavior.

Results and discussions. Psychologists, studying human behavior in recent centuries, have created a significant set of theories about how people behave in society.

Psychology is the science of the general patterns of evolution and functioning of the psyche and mental processes as specific forms of life activity of animals and individuals of the human race [6, p. 7]. Since ancient times, people began to think about the mechanisms of various mental processes (attention, speech, imagination, thinking, etc.), mental properties of the individual (temperament, character, abilities), mental states (fear, joy, sadness), mental formations (knowledge, ability, skills, mastery) [7, p. 44].

Among the main stages of the development of psychology, modern scientists single out [12, p. 24]:

At the first stage (more than two thousand years ago), psychology was considered as the science of the soul. The first system of psychological concepts is laid out in Aristotle's treatise «On the Soul».

In the 17th century in connection with the development of mathematical and natural literacy, psychology was presented as a science of consciousness.

Psychology as an independent science emerged from philosophy in the middle of the 19th century. It was prepared by great successes in the experimental study of natural phenomena.

At the next stage (in the 20th century), psychology is defined as a science of behavior that studies human actions and reactions.

In the transition from one stage to another, the logic of the development of psychology is described. It is not reduced to a chain: soul – psyche – consciousness – behavior. The vector of its movement is represented in the expansion of the explanatory and predictive power of its concepts and categories. Modern psychology is defined as a science that studies the mechanisms, regularities and manifestations of the psyche. The very term «economic psychology» was first used in 1881 by G. Tard [13, p. 38].

In our opinion, accounting is an economic science aimed at meeting the needs of realizing personal potential. But in this connection, the teachings of the founder of psychosynthesis, the outstanding Italian psychoanalyst Roberto Assagioli (1888-1974), are particularly interesting, who believed that the main task of psychosynthesis is to understand one's true self, only by understanding oneself can one achieve inner harmony and obtain satisfaction with one's relations with the outside world. Based on the results of the research, R. Assaggioli formed a personality structure (Fig. 1), which, in our opinion, can be transferred to professional accountants.

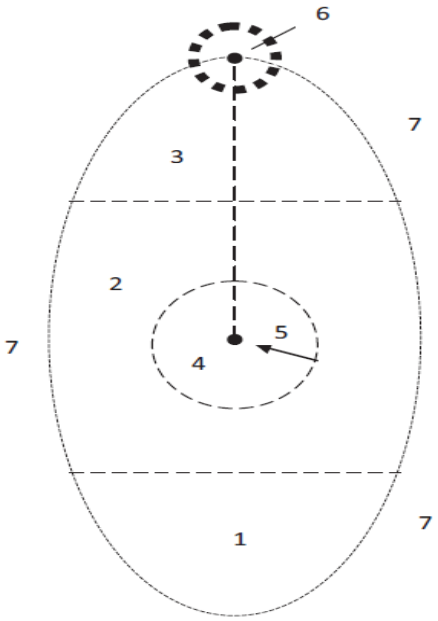

Fig. 1. Map of the inner world of a person, respectively to R. Assagioli

Source: [3, p. 23].

where: 1 – lower unconscious (instincts);
2 – average unconscious (thoughts and feelings that are easily realized);
3 – higher unconscious (abilities, intuition, inspiration);
4 – field of consciousness (analyzed feelings, thoughts, urges);
5 – conscious «I» (the center of our consciousness – the point of clear awareness);
6 – higher «I» (our true essence, it does not change and does not disappear);
7 – collective unconscious.

The outer oval of the map of the inner world, drawn by R. Assaggioli with a dotted line, because the modern personality cannot be separated from the experience of all humanity, which is transmitted from generation to generation.

Undoubtedly, feelings, without which activity is impossible or very difficult, have a huge impact on activity. The work of an accountant involves both the implementation of accounting functions and communication with management, which is expressed in various professional retraining programs, submitted reports on the work performed, communication with various users of financial statements.

Modern scientific research shows that information is perceived by a person through the sense organs in the following way (Fig. 1).

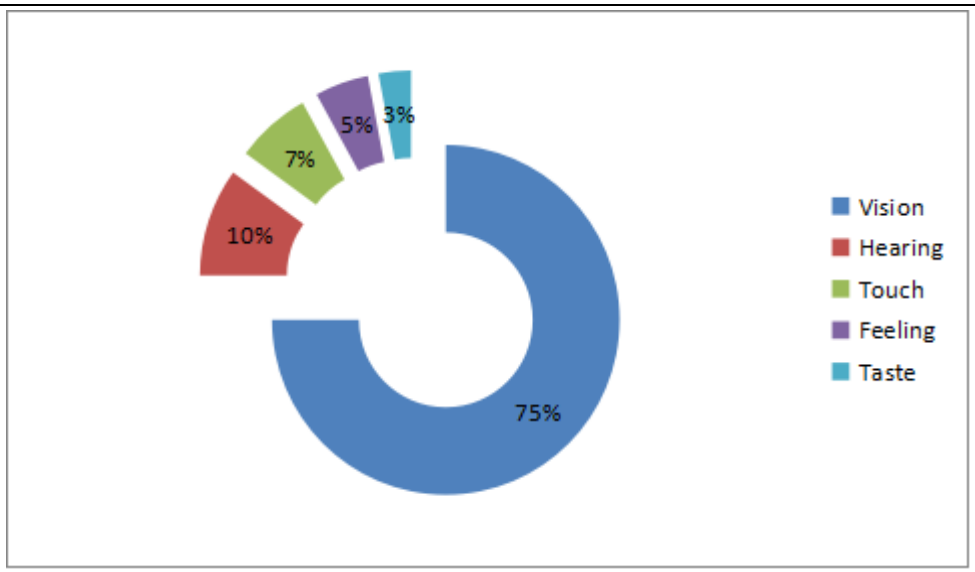

Fig. 1. Ways of perceiving information by a person.
Source: compiled on the basis of [5, p. 62].

Based on this, according to M. L. Pyatov, for the purposes of enterprise management, «an important task is to solve purely psychological problems that arise between accountants who create accounting information and enterprise managers» [18, p. 82].

In this context, we agree with the point of view of A. P. Rudanovsky, Y.V. Sokolov, that the analysis of the received information in the form of financial statements should be considered as a logical continuation of accounting. At the same time, it is impossible not to take into account the industry aspects and their influence on the setting and organization of accounting, since many economic, legal and psychological aspects have different effects on the setting of the accounting process and the formation of reporting. So, for example, in agriculture, in addition to the production process itself, in our opinion, psychological factors of labor activity, including accountants, must be taken into account, which has significant features in their relationship with the subject, work tools, and physical and social environments [21, p. 99].

Today, the work of an accountant is not the most prestigious in society, but no one doubts that this work is necessary [19, p. 203].

When constructing the accounting process, the accountant from the point of view of psychology examines every fact of economic life on two levels – legal and economic. They make demands on him, which forms a predictable decision on which other users of this information depend. It is at this moment that the laws of psychological behavior of a specific person are revealed. Psychological behavior in the dictionary of I.M. Kondakova is defined as the active interaction of living beings with the surrounding world, during which it purposefully affects the object, and due to this, it satisfies its needs [10, p. 98].

Other scientists consider such subject activity one of the main categories of psychology. In particular, the psychological category of activity combines psychology and management theory, which is the basis on which the relationship between the content of management activity and its psychological mechanisms is established. Based on this, the responsibility of a professional accountant is not reduced only to meeting the needs of the employer, but also takes into account the interests of the public, which are largely determined by the standards of the accounting profession (Fig. 2).

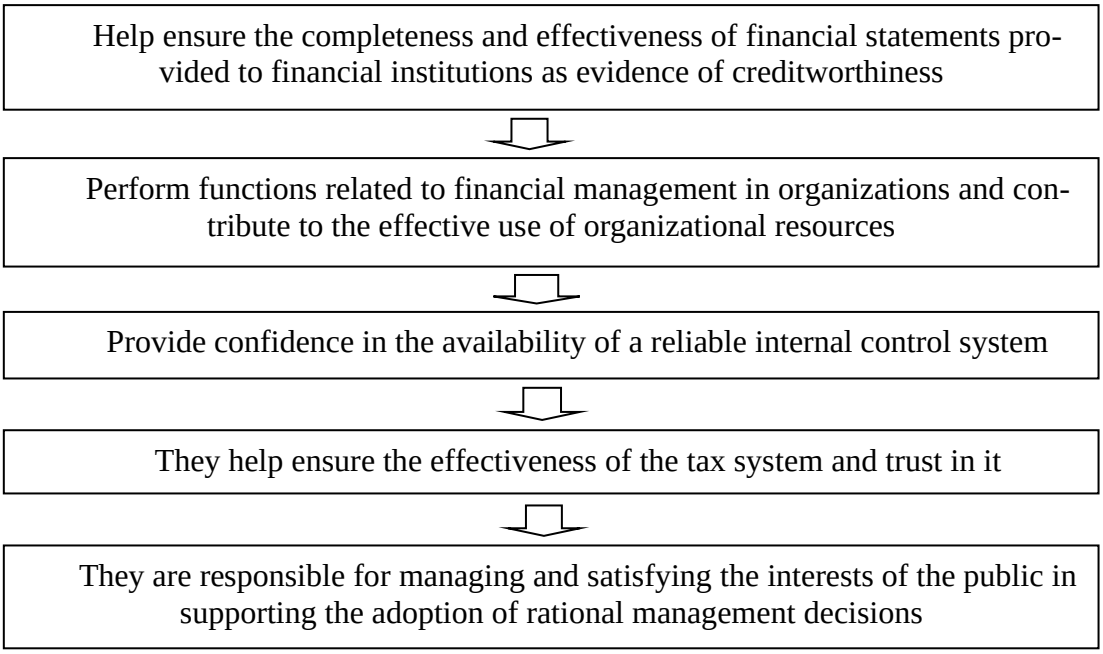

Fig. 2. Social responsibility of the accounting profession.

Source: [7, p. 13].

However, professional accountants will only be able to remain in this position if they continue to provide the public with these services at a high level that demonstrates that public confidence is well founded. Therefore, representatives of the accounting profession all over the world have a vested interest in meeting all ethical requirements.

According to the Code of Ethics, the goals of the accounting profession are to perform their work in accordance with established standards that satisfy the interests of the public [11]. In order to achieve these goals, it is necessary to possess four main factors that are interrelated (Fig. 3).

Criticism of ethical principles for the incomplete possibility of being guided by them in a specific situation drew the attention of researchers of this problem to the psychological attitudes formed by this profession [16, p. 141].

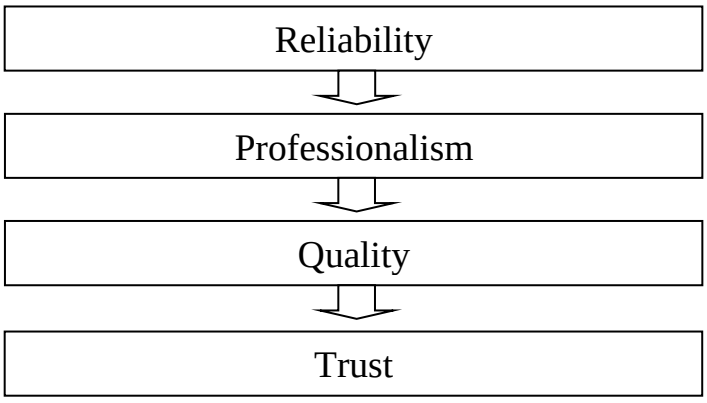

Fig. 3 Factors for achieving success in the accounting profession.

Source: [22].

Thus, A. G. Asmolov singles out three types of accounting systems: semantic, target, and operational (Table 1).

Table 1

Classification of installations by A. G. Asmolov

№	Kind	Content
1	Meaningful	The presence of meaning in the accountant in the form of readiness to carry out activities directed in a certain way.
2	Targeted	The accountant's ability to perform an action set as a goal.
3	Operational	Readiness to perform certain actions arising in connection with the situation of solving the task based on accounting and based on past experience.

Source: [1, p. 102].

An important concept that significantly affects the psychology of the formation of the accounting department at an agricultural enterprise is the concept of motivation (Table 2).

Table 2

The concept of «motivation» in scientific literature

№	Author	Content
1	2	3
1	E. Atkinson, D. Banker, R. Kaplan [4, c. 547]	Motivation is an individual's interest or internal impulse to act in a certain way.
2	S.M. Apenko, V.Yu. Mamaeva [3, c. 103]	Motivation is the process of influencing the motivational sphere of an individual in order to form a willingness to act in accordance with the goals of the subject of management.
3	T.A. Demchenko [9, c. 10]	Motivation is the process of combining the goals of the enterprise and the goals of the employee for the most complete satisfaction of their needs.

The process of motivation includes certain elements that are interrelated. In its general form, it is disclosed by us in Figure 4.

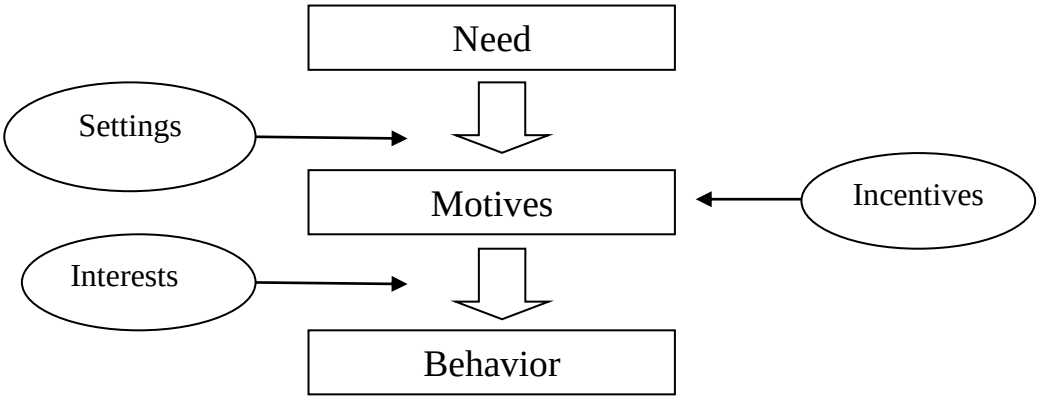

Fig. 4. Interrelationship of the main elements of motivation

Source: based on [17].

For an agricultural enterprise, accounting for the interests, needs and incentives of its employees is very important in creating and improving the motivation system, as it allows determining the direction of their behavior.

The combination of those shown in fig. 4 elements are the mechanism that allows the subject's needs to be satisfied in the most acceptable way – by realizing his abilities, which in the future gives the manager the opportunity to develop an effective system of stimulating the work of the employee, combining, in this way, the goal of the enterprise and the goal of the accounting worker [9, p. 11].

Having studied the main elements of the motivational process, we can say that material stimulation remains the most relevant for workers in the agrarian sector.

We will also consider the psychological aspects of the accountant's activities from the side of the business owner. When hiring an accountant in an agricultural enterprise, two moments arise in the psychology of the employer, which are related to the applicant for this position. In addition to the requirements for qualifications, professional knowledge and skills, there are also requirements for the personal qualities of an accountant. Directors pursue a certain goal when selecting an accountant: some of them expect the accountant to actively participate in planning the organization's activities, while others assign the role of an ordinary employee to the accountant. At the same time, every manager understands that the behavior of the enterprise on the market largely depends on the professionalism of the accountant [20, p. 146].

At the same time, the manager must also take into account that the accountant and his professional judgment are influenced by various factors, such as the psychological characteristics of his personality, the level of professional knowledge, abilities, skills, the scope of the organization in which he works, etc. (Fig. 5).

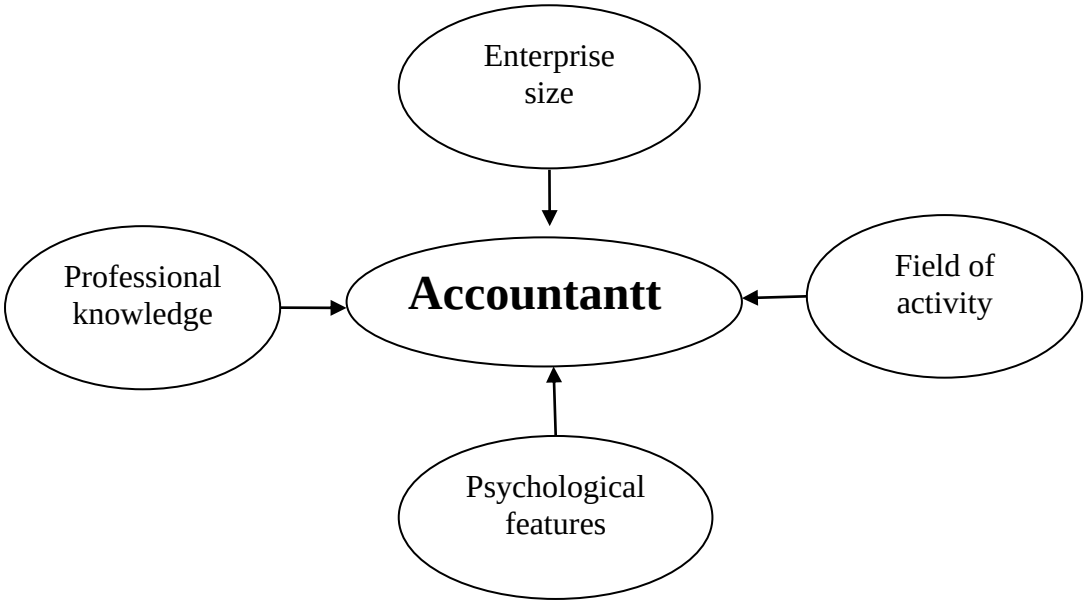

Fig. 5. Factors influencing the activity of an accountant.

Source: compiled on the basis of [15, p. 145].

The accountant is also influenced by the size of the organization he works in. This is especially important at the beginning of an accountant's career, when he gets practical experience. In a small organization, an accountant comes into contact with all areas of accounting and tax accounting, so there is an opportunity to gain practical experience in all areas of accounting, but in large companies, the accountant performs work in one direction and therefore does not get comprehensive practical experience. Here, again, the choice depends on the psychological characteristics of the individual and his inclination to obtain practical knowledge.

Also, the accountant and the formation of his professional judgment is influenced by the industry and the specifics of its activity in which he works. The larger the enterprise in which the accountant works, the higher the management's requirements for his qualification level, the greater the responsibility and professional risks. Because the quality of accounting and the state of professionalism of the audit can affect the economic prosperity of the enterprise (Fig. 6).

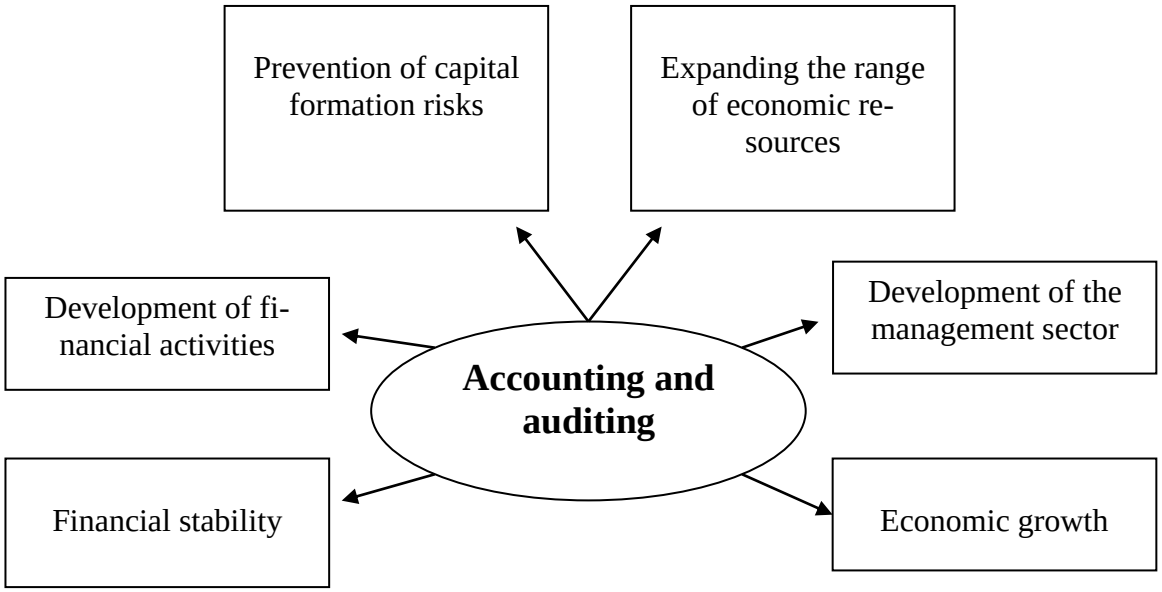

Fig. 6. The influence of the quality of accounting on the activity of an agricultural enterprise.

Source: compiled by the authors.

A psychological audit of an accountant's activity, from the manager's point of view, can be considered from the point of view of such stages of his activity as:

- Admission to a position in the organization;
- Current activity;
- Dismissal from work.

In accordance with the highlighted stages in Table 3, we have given the attitude of the accountant to the information he audits when: taking up a position in the organization, taking into account the facts of economic life and forming reports during current activities, considering and analyzing his work from the standpoint of the legality of the actions performed when dismissal from office.

Table 3

The attitude of the accountant to the elements of accounting

Accounting element	Enrollment to the position	Activity	Firing from a job
Reporting	Distrust	The pursuit of authenticity	Adequacy to the facts of economic activity and legislation
Reflecting the facts of economic activity	Doubts	Trust and risk reduction	Adequacy to the facts of economic activity and legislation
Balance summary	Trust	Trust	Trust
Amount by balance sheet items	Doubts	Trust	Adequacy to the facts of economic activity and legislation

Source: compiled by the authors.

From a psychological point of view, the accountant's personality at the time of the audit at the stage of recruitment and familiarization with documentation and reporting may have such feelings as trust, doubt or mistrust of the information received by him.

Trust means a feeling of complete peace, the absence of any doubts, the complete naturalness of relations, as well as a positive attitude towards an object or subject, based on confidence in its reliability, conscientiousness, reliability or honesty. In turn, mistrust is a lack of trust.

Doubt is the lack of confidence in something, belief in something, uncertainty in the truth of something, the thought of a possible inconsistency with reality.

Under the risk of the accountant is considered the possible danger of any unfavorable result from the position of the organization of tax and financial accounting and the consequences of their management, the occurrence of intentional and unintentional errors.

Conclusions. Ethical and psychological aspects of professional judgment are usually not taken into account by practitioners and scientists, but they can provide the key to understanding the causes and nature of significant errors when choosing accounting methods. Underestimation of the psychological aspects of accounting policy inevitably increases the risk of ineffective decisions in the financial and economic activity of the organization.

The conducted study showed that the psychology of an accountant has a significant impact on the organization of the accounting process, and from the point of view of the individual, not every person can be an accountant. In order to become a professional accountant, in addition to knowledge, abilities and skills, it is necessary to have certain personal and professional qualities, as well as a certain temperament, character and abilities. Thus, the psychological characteristics of the individual are the prerequisites for success in professional activities.

To improve the qualification of an accountant, it is necessary to have knowledge in the field of practical psychology for: first, to know one's strengths and weaknesses and consciously use them both in professional activities, in communication, and in ordinary life situations; secondly, to be able to reveal one's psychological reserves; third, to preserve and maintain their mental and physical health.

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SOME ISSUES OF ANALYSIS OF CAPITAL IN COMMERCIAL ENTERPRISES

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DOI: 10.5281/zenodo.10132280

Abstract
The article shows the economic nature of the capital of a commercial enterprise and talks about a number of issues of capital analysis based on it. Here, the purpose, tasks and information sources of the capital analysis are indicated, and the use of the share ratio of capital in total assets (SRCTA) indicator in the analysis is justified. In addition, some issues of the analysis of the authorized capital, shareholder capital and retained earnings, which are the main components of capital, are explained.
Keywords: assets, capital, SRCTA indicator, retained earnings, financial stability of the enterprise.

Introduction. It is known that the capital of the enterprise is a balance indicator reflecting the amount of its own funds. What is the total amount of capital, in which cases is this amount considered optimal, and in which cases is it considered sub-optimal, or what is the position of the relative indicators reflecting the current state of capital in the financial situation of the enterprise, among the issues that are considered relevant in the economic field, it attracts the attention of researchers. is involved. One of the convenient measures to determine whether the total amount of capital is sufficient for the enterprise is to periodically and regularly analyze the capital. The final provisions obtained as a result of the analysis make it necessary to make management decisions on maintaining the physical volume of capital, whether it is sufficient or not, and whether it should be increased in the future activity of the enterprise.

Capital appreciation. A number of indicators are used to characterize the financial condition of a commercial enterprise. As the scale of such indicators has a wide scope, they are used both in financial analysis and in the organization of management processes, as well as in making management decisions. In addition to these, the indicator of the share ratio of capital in its total assets can form a sufficiently justified opinion in order to briefly and clearly characterize the financial situation of any commercial enterprise. A greater amount of capital results in a higher share of capital in the total assets of the enterprise. In addition, the condition of the components of the capital plays an influential role with various factors in the assessment of the financial condition of the enterprise. All this makes it necessary to regularly analyze the capital and form reasonable opinions about the financial situation of the enterprise through it. Some issues of capital analysis in commercial enterprises have been investigated in the works of a number of economists [4, 14, 15, 16]. Despite this, the capital valuation issues to be commented on here have not been sufficiently investigated.

The main purpose of capital analysis is to make scientifically based judgments about the financial condition and financial stability of the enterprise, and thus help to find directions for the efficient development of the economy of the enterprise. In order to achieve this goal in a favorable way, analysis should be carried out in several directions. First, it is considered appropriate to analyze the total volume of the enterprise's capital, and then its composition and structure. Each of these can be analyzed in different ways, but the judgments formed on the results of the analysis are equally important in directing the development of the enterprise.

Sources of information and tasks of analysis. What information is used in the process of capital analysis may be different depending on the purpose of the analysis and the requirements set before it. To analyze the availability of capital, the current state of its composition and how it changes over the years, it is enough to use the information reflected in the financial statements of the enterprise. However, in order to analyze how the enterprise's capital was historically formed, its development, for what purposes and how it is used in the process of the enterprise's activity, and a number of other such delicate issues, it is necessary to look at information stored in deeper layers, archival materials of the past years, founding documents of the enterprise, distribution of profits over the years and it is required to refer to usage protocols and other such information [1, 3, 5].

The main sources of information for the analysis of capital in general and at the initial stage are the following forms of the financial report of the enterprise:

1. Report on the financial situation: it is a form of financial report that reflects the financial situation of the enterprise in a comparative form. In the "Capital" section of this report, the balance amounts for individual components of the capital of the enterprise are reflected.

2. Statement of changes in capital: it is one of the forms of financial statement reflecting the movement of the private capital of the enterprise. The components of special capital include authorized capital, reserve capital, additional capital, as well as undistributed profits of the reporting year and previous years.

Different kinds of tasks can be put before the analysis of capital. As an example, it is appropriate to show the following:

- ✓ to determine the sources of capital formation, to determine the results of changes in its total volume and composition;
- ✓ to determine the ability of the enterprise to use the capital effectively;
- ✓ evaluate capital increase reserves;

✓ to evaluate the parts of the undistributed profit of the enterprise related to the current year and collected from previous years and other similar tasks.

Analysis process and SRCTA indicator. It is appropriate to start the process of analyzing the capital of the enterprise by collecting, examining, interpreting and presenting information about the current state of its existence and how it has changed over the past few years. Financial statements from the last few years are required to perform these processes. First of all, the dynamic change and development trends of the capital over the years, and then the changes in its composition are analyzed. In modern times, the economic literature provides information about a number of relative indicators that reflect these or other issues of the enterprise's capital [9, 10, 18]. In our opinion, it is appropriate to use another relative indicator here. This indicator is called the share ratio of capital in the total assets of the enterprise (SRCTA). It expresses the ratio of the enterprise's capital to total assets. This indicator can create a preliminary idea that the enterprise has sufficient capital. Thus, the SRCTA indicator can play an important role in assessing the financial condition and financial stability of the enterprise. Here, using SOCAR's financial reports as an example, let's take a brief look at some of the issues of calculating and using the equity ratio in the total assets and using it in the analysis.

Using the information contained in SOCAR's 2018-2022 reports on the financial situation, the following table shows how to calculate the share ratio of capital in the total assets of the company (SRCTA indicator).

Table

Share ratio of capital in total assets of SOCAR
(according to indicators at the end of the year)

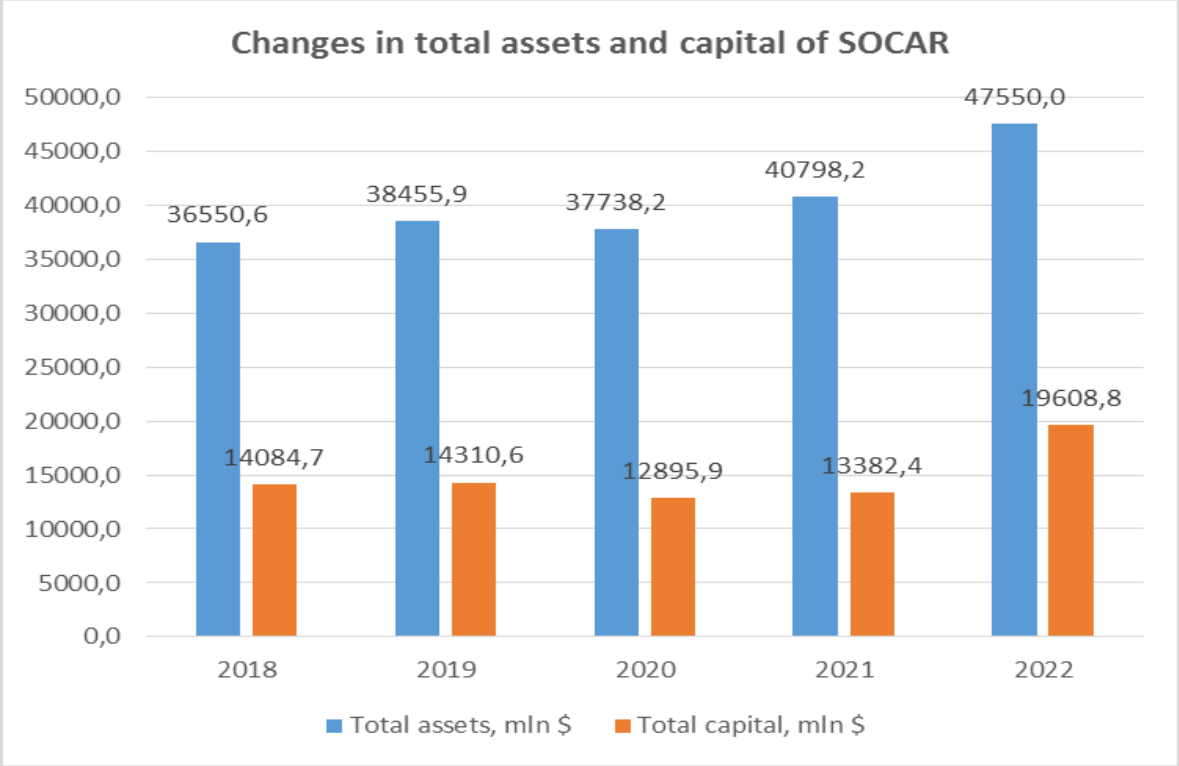
(mln.$)

№	Years	Total assets, mln $	Total capital, mln $	SRCTA indicator, %
1.	**2018**	36550,6	14084,7	38,53
2.	**2019**	38455,9	14310,6	37,21
3.	**2020**	37738,2	12895,9	34,17
4.	**2021**	40798,2	13382,4	32,80
5.	**2022**	47550,0	19608,8	41,24

Source: compiled by the author based on SOCAR's Consolidated financial statements [1]

To calculate the SRCTA indicator, you need to multiply the amount of the company's total capital by 100 and divide it by the amount of total assets. This indicator can give a reasonable idea about the financial situation of the enterprise. Here, the process of calculating the SRCTA indicators of SOCAR at the end of the respective years was carried out as follows:
By the end of 2018: 14084.7 x 100 : 36550.6 = 38.53%;
By the end of 2019: 14310.6 x 100 : 38455.9 = 37.21%;
By the end of 2020: 12895.9 x 100 : 37738.2 = 34.17%;
By the end of 2021: 13382.4 x 100 : 40798.2 = 32.80%;
By the end of 2022: 19608.8 x 100 : 47550.0 = 41.24%.

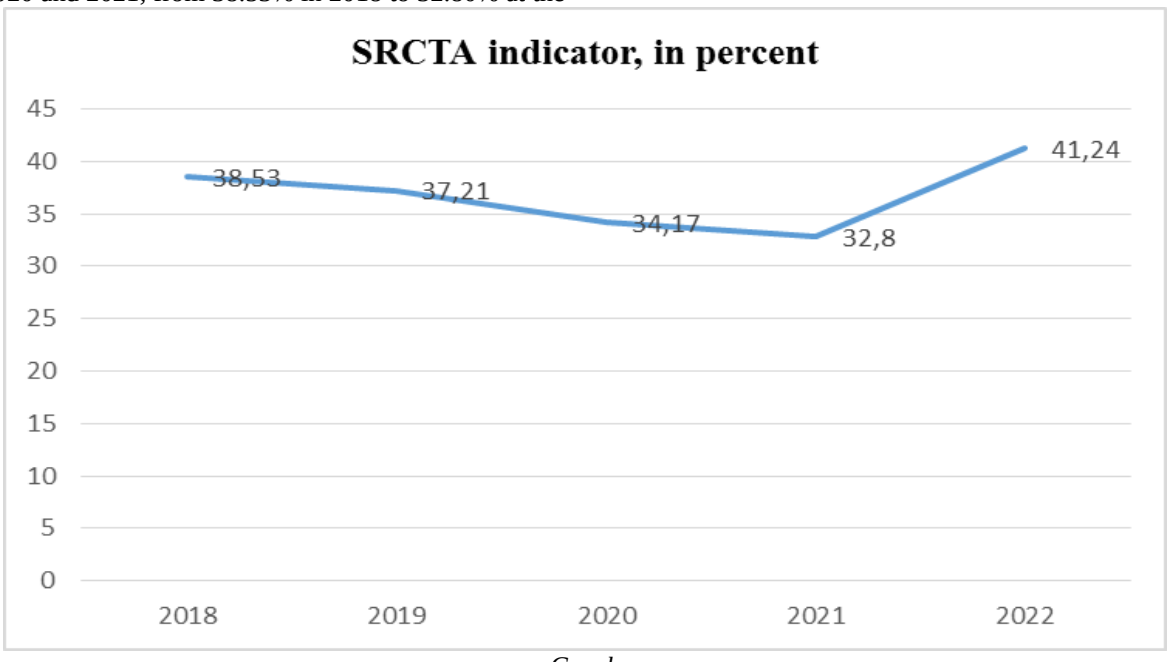
As can be seen from the information reflected in the table, serious changes have occurred in the total amount of assets and capital of SOCAR in 2018-2022. Thus, in the specified 5 years, the total amount of the company's assets increased by $10,999.4 million, or 30.1 percent, and the total amount of its capital increased by $5,524.1 million, or 39.2 percent. The amount of both assets and capital has changed unevenly over the years, sometimes increasing and sometimes decreasing. Here, the decline in 2020 attracts more attention. In that year, the company's assets decreased by $717.6 million, and its capital decreased by $1414.7 million. The company ended the year 2020, when the pandemic prevailed all over the world, with a loss of $1,155.9 million, as a result of which the amount of its total capital decreased by $1,414.7 million. Although the situation has improved slightly in the next year 2021, the total amount of capital has still not reached the level of 2019. In 2021, the capital increased by $486.5 million compared to the previous year, which was not enough to reach the level of 2019. A significant increase in the company's assets and capital took place in 2022, which is related to the improvement of its management system. As can be seen from the presented information, in 2022, compared to the previous year, the amount of assets increased by $6,910.6 million, and the amount of capital increased by $6,226.5 million, which is the highest indicator in the analyzed five-year period. How the company's total assets and capital have changed is reflected in the next diagram (Diagram).



Diagram

Source: Compiled by the author based on table information

As reflected in the chart given here, in 2018, 2019, 2021 and 2022, when the company's assets increased, its capital also increased, and in 2020, when it decreased, its capital also decreased. Undoubtedly, there is a hidden connection between these two indicators, which is not easy to see, and its investigation will be the subject of another study. Here, we consider it appropriate to focus on the SRCTA indicator. This indicator is reflected in the last column of the above table. As can be seen, the value of the SRCTA indicator expressed as a percentage gradually decreased in 2019, 2020 and 2021, from 38.53% in 2018 to 32.80% at the end of 2021, 3 5.73% decrease occurred during the year. In our opinion, this means that the company has blown money over the years, and the rapid growth of its assets has not resulted in a corresponding increase in capital. Such a negative situation was eliminated only in 2020. At the end of that year, the SRCTA indicator increased by 8.44% compared to the previous year and reached 41.24%. How the company's SRCTA indicator changes over the years is reflected in the following graph (Graph).



Graph

Source: Compiled by the author based on table information

As can be seen from the given graph, the SRCTA indicator of the company has tended to decrease regularly from year to year in 2018-2021, and only in 2022 it increased and rose above the level of 2018.

In our opinion, the indicator of 2022 reflecting the share ratio of capital in total assets in SOCAR can be considered very favorable and high for a commercial production organization. This ratio shows that 41.24% of the company's total assets are its own funds, and the remaining 58.76% are borrowed funds. In general, we consider it reasonable to accept the SRCTA indicator above 33.3% as a guarantor of the strength of the financial stability of the enterprise for this type of commercial enterprises. This indicator reflects that the total capital of the enterprise is more than 1/3 of the amount of its total assets.

Features of the analysis of capital components. One of the important directions of capital analysis is the examination of its constituent parts. When analyzing the composition and structure of capital, it is necessary to take into account the characteristics of each part of it. When analyzing the composition and structure of the capital, it is appropriate to pay special attention to the authorized capital of the enterprise. The charter capital consists of the amount of funds that the founders invested in its property during the establishment of the enterprise. In Western literature, this type of capital is called nominal capital [7, 8, 19]. The authorized capital can be reorganized, increased or decreased during the operation of the enterprise. Necessary information about its volume (amount) and how it is organized is reflected in the founding documents of the enterprise [21; p. 330]. The most important of these documents is the charter of the enterprise. The status of the authorized capital during the reporting period is reflected in the report on the financial status of the enterprise, and its increase or decrease is reflected in the report on changes in capital. When analyzing the authorized capital, first of all, the completeness of its formation is evaluated, if necessary, it is determined which of the founders has not fulfilled their obligations to invest in the authorized capital. Then, the cases of its increase and decrease in the period covered by the analysis are examined, and the reasons, sources, directions and results of the changes are interpreted [2, 22].

In enterprises and organizations with the organizational form of a joint-stock company, the authorized capital is formed in the form of share capital. When analyzing shareholder capital, it is necessary to determine whether the organization has its own shares purchased from shareholders and the purpose of their purchase. The peculiarity of share capital is that through it many legal and natural persons invest in the enterprise on a long-term basis and they become the main legal owners of the enterprise through equity instruments [12, 17]. The social context of high share capital is that the shareholders of the enterprise are a part of the people in general, and thus it is known that the enterprise belongs to the people in the form of shareholders. The higher the share of publicly traded shares in the country, the more people-owned the economy is. Therefore, it is considered appropriate to consider the share of the share capital in the total capital of the enterprises existing in the country or region as one of the indicators reflecting the extent to which the economy belongs to the people.

One of the parts of capital that should be paid special attention to is retained earnings. Retained earnings consist of the total amount of the unpaid parts of the net profit in the form of dividends earned by the enterprise in the process of long-term financial and economic activity [13,20]. These parts of the profit over the years remain accumulated and are added to the capital of the legal owners of the enterprise. When analyzing retained earnings, it is necessary to evaluate the change in its share in the total amount of capital. A decrease in this indicator may indicate a decrease in business activity and therefore should be the focus of the analyst's attention.

The result. Thus, capital analysis plays an important role in forming a correct picture of the company's financial situation. In the analysis of the capital, it is proposed to use the capital share ratio (SRCTA) indicator in the total assets, and the method of calculating this indicator is shown. Also, it is proposed to consider the share of shareholder capital in the total capital of enterprises existing in the country or region as one of the indicators reflecting the extent to which the economy belongs to the people.

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FORECASTING ENVIRONMENTAL PROBLEMS CAUSED BY OIL AND GAS INDUSTRY OPERATIONS

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Abstract

The territory of Azerbaijan, rich in underground and surface resources, is also rich inhydrocarbon resources. The development of hydrocarbon deposits in the Azerbaijani sector of the Caspian Sea, agreed upon in the "Contract of the Century", gave impetus to joint development with the world's leading oil companies and contributed to the development of oil and gas fields in Azerbaijan. The oil and gas complex has given a special impetus to both the economic and social development of Azerbaijan. One of the main tasks facing the Republic of Azerbaijan is to ensure the energy needs of the population, consolidate achievements in the successful development of the economy. In this article, we analyze the environmental and economic risks that arise both during the development and further oil processing of oil and gas fields. The purpose of the study is to develop proposals for more effective prevention of environmental risks on the example of some fields in Azerbaijan. The subject of the study is the fuel and energy complex of Azerbaijan and at the same time the issue of ensuring ecological balance. The proposed article is based on the study of some problems of harming the environment of some fields of Azerbaijan in order to minimize the impact on the environment.

Keywords: forecasting environmental pollution, oil and gas industry, environmental risks, pollution prevention.

Introduction

The development of the oil and gas complex in the world and in Azerbaijan has been the basis of the progress of society and the economy for many decades. Today, the development of energy has becomeone of the most successful and decisive directions of state policy in the Republic of Azerbaijan. The wealth of the oil and gas complex allows us to build a sovereign Azerbaijan, create a modern state. With all the available opportunities and potential sources of energy, Azerbaijan with a transitional economy is ahead of other countries in the same situation.

The rapid development of the oil and gas complex should not only meet the energy needs of the population, but also serve its well-being. The development of the oil and gas complex of Azerbaijan makes it possible to ensure sufficiently high rates of economic development, but at the same time creates a number of environmental problems in the state. Therefore, it is important to ensure the environmental safety of the oil and gas complex, as well as the population's need for energy resources primarily through the development of renewable energy sources.

Since the oil and gas complex is closely connected with all spheres of life in Azerbaijan, its condition has a significant impact on the socio-economic policy of the state. Thus, the sharp drop in oil prices over the past year has significantly complicated the socio-economic situation in Azerbaijan as a whole. Therefore, the analysis of the current state of the leading sector of the Azerbaijani economy – the oil and gas complex as a whole, the identification of factors affecting its development, is an important and urgent task.

The purpose of the study is to develop proposals for more effective prevention of environmental risks on the example of oil and gas fields of Azerbaijan.

The subject of the study is the state of the oil and gas complex of Azerbaijan and at the same time the issue of ensuring ecological balance in its development.

The scientific novelty of the research consists in studying and grouping the strategy for thedevelopment

of the oil and gas complex in Azerbaijan, developing proposals for the effective use of energy sources and taking measures to prevent the impact of this use on the environment.

Literature review

The oil and gas complex, primarily the oil industry, plays an important role in socio-economic development, in mobilizing the entire economic potential of the Republic of Azerbaijan. It is no coincidence that the Azerbaijani state, pursuing an "open door" policy based on the principles of mutually beneficial cooperation, creates favourable conditions for the participation of foreign capital inthe development of oil fields [1].

The study of issues related to this gas topic was reflected in the works of many researchers, afterthe Republic of Azerbaijan there is a significant potential for the development of the oil industry, which is the basic structure of the economy [2], official statistics [3] and other sources, the authors examined the problem as a whole and highlighted many aspects of the development of the oil industry.Describing the dynamics of the development of the oil industry of Azerbaijan, these authors, in addition to focusing on the activities of Western industrialists, also explained the activities of representatives of Russian capital, which has a large multinational structure [4].

Many works have been written both on environmental protection and on the effective use (forecasting) of natural resources [5]. In the works of M. D. Goldfein, N. V. Kozhevnikov, N. I. Kozhevnikova other researchers [6], forecasting methods and their basic principles are studied.

Information about the oil and gas complex of Azerbaijan was repeatedly emphasized in the writings of early medieval researchers and travelers [7] the first information about the extraction and distillation of Baku oil by wells was given in his writings by the Arab historian of the 13th century, Muhammad ibn Najib Bakran [8].

The rapidly developing oil and gas complex in the modern world is the basis for the developmentof key economic sectors and determines the progress of social production. To this end, the scientists conducted extensive studies of the economics of the oil and gas complex and reflected the results in their works. Research by Ukrainian and Azerbaijani scientists Vagif Gadirov, Oleksandr Menshov, Roman Kuderavets, Kamran Gadirov on structural forms, formation and destruction of oil and gas deposits, geographical location of the main oil and gas-bearing deposits of Ukraine and Azerbaijan showed that oil deposits, regardless of their structural form, in gravitational and geomagnetic fields aremarked by local minima, and the intensity of local gravi-magnetic minima depends to a greater extent on the strength of the oil and gas reservoir than on its depth [9]. Rafiga Huseynzade, Azer Aliyev research the historical experience of the construction of main oil and gas pipelines and its environmental priorities for Azerbaijan. The experience of the above-mentioned country's oil and gas industry in exploration, production, processing and transportation was studied in the collections of works of authors who lived in the Middle Ages, in particular, the first oil well in the world was drilled on the Absheron Peninsula in Azerbaijan in 1846 [10]. It is also worth noting that the oil industry of Azerbaijan has gone through various stages of decline and recovery during the entire period of development, but despite this, many oil and gas fields have been discoveredand developed in the country. At the current stage of its development, the oil and gas industry accounts for about 90% of Azerbaijan's export revenues and about 60% of the country's state budget. The development of the oil and gas industry contributed to a significant increase in the standard of living in Azerbaijan since the late 1990s. Thus, Azerbaijani oil scientists have become famous not only in their own country, but also abroad for their practical and scientific activities.

R. N. Nuralieva the monograph "Economic and environmental problems of the development of the fuel and energy complex of Azerbaijan" shows the theoretical and methodological foundations of the relationship of the oil and gas industry with the environment, analyzes the environmental situation in the country, highlights the principles of environmental protection [11].

One of the important tasks facing the oil and gas complex of the Republic of Azerbaijan today is to better meet the needs of the economy and the population of the country in energy resources and consolidate the results achieved. To fulfill this important task, the "State Program for the Developmentof the Fuel and Energy Complex of the Republic of Azerbaijan" provides for the implementation of specific measures for their implementation in the next decade and defines the directions of development of territories [12, 13].

Results and discussion

In the next decade, due to the shortening of the life of oil and gas fields, the Azerbaijan State Oil Company (SOCAR) will face problems in the process of oil and gas production, as well as in the supply sector. This is considered a natural phenomenon, but, thus, a reduction in production in large and intensively developed territories over the course of a century will be inevitable. According to forecasts, in 2025, oil supplies to the country will be reduced to 6.9 million tons with an annual reduction of 1-2%. During this period, the country's population will increase by 22% from 10 million to 11 million in 2025 [14].

A stronger economy will increase investments in the social sector and improve people's well-being.A favourable social situation will be accompanied by an increase in energy demand. In such conditions, the number of cars in the country will double and in 2025 will average 2 million. Currently, the country needs 1.1 million tons of pure gasoline and 1.2 million tons of diesel fuel. It is expected that in 2025 the demand for gasoline will grow by 80%, and for diesel fuel – by 2 times. To meet this demand, SOCAR needs to increase production from the current 6 million tons to 9 million tons in 2025. This situation will affect the productivity of the oil and gas industry, and, accordingly, this process will affect the growth rate of GDP. In different development scenarios, this impact can be multifaceted: first of all, the decline in oil production by SOCAR will affect its capital intensity and foreign exchange earnings. As a result, the country's impact on economic growth in the oil sector will be limited. On the other

hand, the country's transport sector will suffer from this deficit, and it will have to create its own new supply system. Naturally, SOCAR will replace the loss of oil in GDP with an increase in gas production. However, the decline in oil production will affect gas production to some extent. In this context, it is important to note that natural gas currently dominates the global oil and gas complex. The world has entered a period of growth in natural gas consumption. It is sometimes called the "methane age" of modern human civilization.

It was noted that natural gas reserves in Azerbaijan have great potential. This optimistic scenario (with an increase in natural gas production) leads to another perspective: despite the growing gas potential of the republic, based on modern economic realities and environmental requirements, it is necessary to use it more effectively and create appropriate production structures in this direction. Based on the long-term goals of the Azerbaijan national oil strategy, at the next stage of development, it is necessary to use gas resources more efficiently and develop the gas chemical industry, especially when opening new gas and energy enterprises, increasing production capacities and creating new gas technologies.

According to the processing technology, 85-90% of the mixture of natural and associated gases is methane, used in everyday life and energy [15-19], the rest is ethane, propane, etc., which are valuableraw materials for gas chemistry. It is impossible to organize efficient processing at the Garadagh gas processing plant, which is operating at full capacity and does not meet modern technological and environmental requirements. Therefore, it is necessary to build new modern plants of such production capacity that would meet modern technological standards and volumes of gas produced in the country, as well as the creation of a gas chemical complex based on valuable components. The main problems of economic and environmental processes in the oil and gas complex consist in changes in the nature of the environment, determining the relationship between their social and production results, determining the scale, nature and trends of environmental change, identifying areas with a bad environment. Therefore, it is important to carry out economic and social assessments, and each assessment should have a certain value. From the point of view of individual interests, it is desirable to give more preference to profitability criteria, but this inevitably undermines the balance in environmental protection, in nature protection. Consequently, the work to be done in order to obtain acceptable forecasts requires the early development of criteria for socio-economic assessments that arecorrect from the point of view of the welfare of society. The application of such criteria increases the importance of forecasting structural changes taking place in the Azerbaijan economy, and at the same time requires clarification, grouping and improvement of issues embedded in several existingmethodological indicators and forecasting methods.

In recent years, as in economically developed countries, in the countries of the Republic of Azerbaijan, special attention has been paid to forecasting, which is an integral part of socio-economic management. Since long-term planning in the EP Environment Protection areas is pre-determined for 15 years, the useful life of the forecast that forms the basis of this planning should not be less than 20 years.

In our opinion, the structure of the sector forecast units can be presented in the form of Table 1.

Forecasting is carried out on three levels: a) the first one is for individual enterprises and industrial associations (forecast of environmental impact); b) the second one is for a specific region (a comprehensive forecast and assessment of expected results reflecting changes in environmental quality); c) the third is in the industry as a whole (summary forecast).

According to the structure of the proposed ecological and economic forecasting, it is advisable to classify the methodology of forecasting the technical impact in the field of EOS on the basis of two basic principles: to determine the scale of interaction with the environment; to study the quality of the environment. At the same time, the statistical method can be used to predict the degree of impact of territories on the environment. However, it should be noted that it is not always possible to use statistical methods to determine changes in environmental quality. For this reason, we believe that the most effective methods in the current situation are cartography, geophysics, experiments and combined methods. The statistical method should be applied only to selected indicators with initial data.

Table 1.

Structure of industry forecasting issues in the oil and gas industry *

Scientific and technical section of the forecast	**Socio-economic section of the forecast**
- analysis of the ecological situation at thelocations of field facilities and study of factors affecting the EPA;	- forecast of eco nomic losses, depending onthe nature protection options;
- study of the impact on the nature protection activities of STP at the predicted time;	- calculation of socio-economic assessment of the results of each option;
- environmental pollution and the amount of pollution, the development of forecasts for changes in regulatory frameworks, changes in the composition and structure of toxic components;	- determination of the efficiency of nature protection measures and selection of a suitable option;
- characteristics of alternative variants of nature protection measures, the volume of capital investments and operating costs;	- proposals and recommendations for theformation of a plan of nature protection measures that provide long-term goals andstandards;
- characteristics of alternative options of nature protection measures, volume of relevant capitalinvestments and operating costs;	

* compiled by the author on the basis of [11]

To predict the expected socio-economic results, it is advisable to use a balance method, an economic and mathematical model, a survey method and a combined method. It is advisable to use the regulatory option to study the protection of the environmental quality standard and factors affecting the environment in a regulatory situation; the main purpose of using the intermediate forecast option isto study the degree of environmental impact of territories where a certain level of environmental protection measures is in effect.

Based on the above, the following key points can be noted when developing the scientific and technical part of the forecast: a) analysis of the current environmental situation; b) forecast of the scale of the object's impact on the environment and nature protection [20-23].

However, it should be noted that in order to implement the above measures, some changes are needed (consideration of several variants of forecasts, the use of more effective forecasting methods, improvement of the forecasting system). At the same time, the analysis of the environmental situation as the initial stage of the forecast development is the basis for further research.

Increased demand for carbon-intensive energy as a result of population and income growth leads to an increase in IEW emissions in general (Table 2).

The forecast data depends primarily on a comprehensive and accurate analysis of the state of the environment. The main purpose of the analysis is to collect, process and systematize the initial data necessary for making a forecast.

The following questions should be taken into account in the analysis: 1) identification of factors affecting the environment at the facilities of the oil and gas industry; 2) determination of the scale and type of impact; 3) detection of trends and qualitative changes in the activity of the natural environment; 4) study of the scale of damage caused by objects of the oil and gas industry; 5) identification of a situation that may create an environmental threat in the region.

The data obtained for analysis should be based on field statistics and monitoring system data. Currently, the wells are in the process of creating a field control system in the most dangerous areas. The main issues of forecasting changes in the quality of EPC under the influence of oil and gasindustry enterprises are: 1) identification of pollution zones and qualitative changes in the environment due to toxicconcentrations; 2) determining the degree of quality deviation in the EPA compared to the regulatory situation; 3) identification of the crisis zone of the natural system.

Table 2.

IEYQ Waste sources, Azerbaijan ("No action taken" scenario, 100th year GWPs) *

Sector	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Transport	2.2	4.2	5.0	6.6	7.0	7.7	8.4	9.2	9.9	10.7	11.6
Industry	6.4	2.8	1.6	1.4	1.0	0.8	0.7	0.8	0.9	1.1	1.6
Place of residence	3.7	6.6	6.5	6.4	7.3	8.3	9.4	10.6	11.9	13.3	14.9
Commercial	0.8	0.0	0.2	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2
Agriculture, Forestry andFisheries	0.3	0.8	1.1	1.3	1.3	1.2	1.0	0.9	0.8	0.6	0.5
Electricity	11.0	14.1	10.5	10.3	10.3	10.2	10.2	10.4	10.7	10.3	11.6
Gas Production	4.7	5.1	11.7	12.1	12.3	12.6	13.0	13.2	14.2	14.7	15.9
Other powersupply	4.2	5.6	4.3	5.4	5.3	5.3	5.3	5.2	5.3	5.3	5.4
Industrial processes	0.6	1.8	2.1	2.8	3.2	3.8	4.4	5.2	6.1	7.2	8.4
Agriculture	5.4	6.5	7.2	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5
Land Use and Forestry	-4.9	-5.3	-5.4	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
Waste	1.8	2.0	2.3	2.4	2.6	2.7	2.9	3.1	3.3	3.5	3.7

* compiled by the author on the basis of [24]

The most effective method for predicting EPA quality variability is the cartography method. The map is a visual aid on topography, zones and directions of environmental pollution. The cartographic model allows you to select suitable sites for the placement and development of an object, while prohibiting the placement of new industrial facilities in certain territories or suspending or significantly limiting the operation of existing ones. Experiments show that the cartographic method ismore reliable because it is tracked using environmental maps compiled in the UK. In Germany, these maps are used to determine the level of air pollution with sulfur dioxide. The main difficulty when using the mapping method is calculating the concentration level in accordance with the concentration. However, a number of proposals, guidelines and geophysical models have been written and published in this area [25]. However, these substances make it possible to more accurately determine the degree of air pollution.

When choosing a method for determining economic damage, the possibilities and goals of a specific forecast should be taken into account. It should be noted that to determine the local damage separately, calculations are required for each damage. For example, when determining the damage (Yd) caused by the deterioration of public health, three of its main components are taken into account: non-labor national income as a result of refusal to work (Qn y/week) Qn/g w for health reasons; payment of benefits to persons with temporary disability (Qab w); medical expenses of the patient (Qm.c):

$$(Qm.c)(Qm.c)Y_d = Qn/g\ w + Qab\ w + Qm.c \quad (1)$$

Production losses are due to an increase in the depreciation rate of certain fixed assets (Af); valuable raw material wastes released into the atmosphere (Arw); losses incurred during high employee turnover are calculated (A).

$$A_S = A_f + A_{rw} + A \quad (2)$$

When calculating the damage to housing and communal services (H_{cs}) from air pollution, the following is taken into account: the cost of cleaning the additional dust generated in the areas allocatedfor construction in the city (H_{cl}) public transport ($H_{p.t}$) value-added expenditures of housing funds and other objects of the city (H_{cost}) additional costs of household services (H h.); damage to urban landscaping (H_d.)

$$D_h = H_{cl} + H_{p.t} + H_{cost} + H\ h. + H_d \quad (3)$$

In order to use the method described above to determine economic losses, it is necessary to collect, analyze and summarize a large amount of information according to this scheme, the complexity of obtaining such information is due to their nature. It should be pointed out that it is impossible to obtainthe necessary data in a generalized form, since there is no single body in Azerbaijan that would deal with this. Moreover, there are problems with the collection of primary data, since it is impossible to obtain the necessary information for all enterprises. In the future, the calculations will use the data of

SOCAR, the state oil company of Azerbaijan, the largest in the republic.

The method of calculating the specific gravity of damage is given below. For example, theeconomic damage from concentrates is determined by the following formula.

$$D = Z.i\ R_i + D_{a/culture}\ R_i + D\ e.\ S_i + D_{in.i}\ F_i \quad (4)$$

$D_{h/I}$ – i specific gravity of health damage in the zone;

R_i – i number of populations living in the zone;

$D_{a/culture}$ – i specific weight of damage to forestry;

S_i – i zone suitable forest areas;

$D\ e.$ – i zone specific gravity of damage to the environment;

$D_{in.i}$ – i zone specific gravity of damage to the industry;

F_i – i the value of the main funds of the industry.

Thus, when calculating economic damage by this method, differentiation of pollution levels in zones requires the collection of a large amount of preliminary data. Accordingly, it can be said that theexisting scientific and methodological work does not allow taking into account the indicators characterizing economic damage when planning and forecasting the gas industry in the field of EOS.

To predict the economic damage from air pollution using an extended assessment method, the following indicators should be taken into account:

1) the volume, composition and composition of toxic substances released into the atmosphere;

2) changing the nature of pollution;

3) forecasting of economic damage.

Azerbaijan's transition to a market economy is accompanied by high activity in the development of the oil and gas sector, but the severity of the economic crisis has led to a deterioration in the quality of the environment and, as a result, the deterioration of the health of the population in crisis conditions, a decrease in life expectancy and other adverse demographic consequences. Thus, there is a great needto create a new state environmental policy aimed at ensuring rational use of natural resources, improving the state of the environment and reducing the negative impact on human health, without which sustainable development and stability of society as a whole is impossible. The concept of "sustainable development" for the "society-environment" system should be understood as follows:

- sustainable social development, involving the use of sources to ensure equality of community members and create conditions for social justice;

- ecological sustainable development, in which human well-being is ensured by the protection of natural well-being and the quality of the environment.

According to the World Bank, sustainable development means achieving the following goals [26]: environmental degradation, biodiversity diversity, protection of favorable environmental conditions, etc. [27; 28]; environmental goals; simple economic goals that ensure the development and efficiency of the economy; social goals [29].

However, achieving one of the above goals contradicts the realization of social goals with an increase in production in the economy, or rather, there is a contradiction between environmental and economic goals. Taken into account the sustainability of economic and social development and its compliance with environmental requirements, it is necessary to understand the main problem – the importance of minimizing negative environmental consequences for future generations. And in orderto determine the specific goals of this development and to take into account the long-term environmental consequences of any enterprise (economy) affected by pollution and environmental degradation, people's economic activity can be considered the primary and most important element of this process. To minimize such negative impacts, it is necessary to develop a strategy (from the point of view of restoring quality) that ensures that the economy meets the environmental requirements of measures aimed at reducing the burden on the environment. Adoption as a technological, financial and economic measure supports the goal of production – the necessary income, according to experts, four types of strategies can be applied. The first strategy is based on the fact that when calculating the effectiveness of any production or trade operation, it is necessary to take into account the economic damage caused by environmental pollution as a result of this operation.

The second strategy should be to minimize the amount of waste in technological processes through regenerative measures. The third strategy is aimed at reducing environmental risk and can be applied at enterprises that have reliable environmental protection measures, but use highly toxic and radioactive materials in their production. The fourth strategy is aimed at minimizing the overall impact of the enterprise on the environment. When implementing this strategy, the company can apply more radical changes in its production and trading activities, for example, the cessation of production of certain types of products. The choice of a particular type of strategy is based on the analysis of the following parameters:

- the general environmental situation in the region;

- production capabilities (enterprises);
- the level of availability of environmental protection equipment in production activities;
- financial stability of the enterprise;
- innovative activity in the implementation of the medium- and long-term strategy of the enterprise and the policy of restoration of production.

As part of the expansion of the level of economic activity to adapt to environmental requirements, much attention should be paid to environmental monitoring and environmental expertise (verification and assessment of compliance of economic activities with environmental protection requirements).

Every country, including Azerbaijan, contributes to the global environmental crisis. Such a contribution can be assessed by ecological significance, the size of territories in which natural ecosystems are disturbed or not disturbed, as well as by the consumption of primary pure biota (flora and fauna) in each other and in each country. The current environmental situation has forced each country to consider environmental problems in a global context [30-32].

According to international experts, natural gas coming from Turkmenistan to Nakhchivan, via Iran, can further expand the capacity of SGC in Turkey in the future [35]. As well as the implementation of the Trans-Caspian Gas Pipeline project (Trans-Caspian Gas Pipeline, "TCGP") will allow the Central Asian countries to supply gas to the countries of the continent in the amount of an additional 10-12 billion cubic meters per year through the territory of the Republic of Azerbaijan and Turkey. According to many experts, Caspian gas supplies can pass through the TANAP and TAP gas pipelines, and the countries of the region can increase their importance in the global economy and receive additional profits [35]. The production and supply of liquefied natural gas (LNG) also has good prospects, is a politically and economically profitable direction.

Conclusions

The article proposes directions for forecasting environmental problems caused by oil and gas industry.

Based on the analysis, a number of important results have been achieved in the protection of nature and the environment, and it is recommended to implement measures that include:

1. Apply an effective implementation mechanism that combines the types of economic and administrative impact. First of all, it is about environmental safety measures at enterprises.

2. Improving the environmental literacy of the population and oil and gas companies. The most successful method of achieving this is the introduction of seminars – advanced training courses for specialists of the oil and gas industrial complex.

3. Increasing the number of environmental measures. The state should play an important role in this.

4. Rational use of non-renewable energy sources and expansion of the use of renewable energy sources.

5. Development of the non-oil sector in order to reduce the use of oil. Again, we are talking about renewable energy sources.

6. Strengthen the process of recultivation of polluted lands. Local self-government bodies and territorial communities are able to ensure this, therefore it is recommended to give them greater powers to solve this task.

7. Strengthen the material and technical base of oil and gas producing enterprises with new equipment and technologies. Establishment and development of cooperation with foreign partners is ofgreat importance here.

Thus, on the one hand, the development of the oil and gas industry contributes to the economic well-being of the state, on the other hand, it generates more and more environmental problems. This is a well-known global model of economic development, which is aimed at short-term interests, unlimited growth and consumption of natural resources. We recommend thinking about the future and implementing strategically important measures, in particular switching to renewable energy sources.

Regarding the operating oil and gas complex, effective management of strategic as well as specific risks should be based on comprehensive identification and description of risks, as well as identification of key indicators of the oil and gas industry, which will allow in practice to comprehensively take into account both the negative consequences of the event and the positive ones. Additionally, in order to minimize political and economic risks, to ensure uninterrupted and reliable export of natural gas from Azerbaijan to the countries of the continent, it is advisable to have alternative routes for transporting natural gas, taking into account the risk of the transit country.

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MAIN MODERN ASPECTS OF MARKETING IN FITNESS INDUSTRY IN THE CASE OF HIGH LEVEL OF MARKET COMPETITIVENESS

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Abstract

The popularity of fitness among the population has led to an increase in the number of enterprises providing these services. With increasing competition and a decrease in the solvency of the population due to the economic crisis in the Kazakh economy, the issue of promoting fitness services arises. The market for fitness services, from the point of view of scientific understanding, has been practically unstudied. However, modern domestic science has accumulated some experience in studying the marketing of services. This article discusses the issues of promoting fitness services in the modern Kazakhstan market.

Keywords: Fitness, fitness business, marketing, promotion, marketing in fitness industry, marketing instruments.

Currently, the services of fitness centers are among the ten most popular services in Kazakhstan. The growing level of well-being of residents of both large and small cities leads to the fact that the population begins to pay increased attention to their health, physical condition and appearance. Moreover, the need is growing precisely for high-quality services, which can only be provided by modern, well-equipped sports and health clubs and fitness centers. People want not only to play sports, but also to have a good time in their free time. After all, playing sports is one of the components of our leisure time. With a high level of competition in the fitness services market, where each fitness club is trying to increase the number of its clients by meeting their specific needs, the question of studying the marketing mix is certainly relevant.

A fitness service is a process that occurs between the client and the club providing the service. This is a deeply individual process, since the service is consumed at the time it is provided. If you are not satisfied with the product, you can exchange it or get your money back. This cannot be done with the service. You will not be able to refuse, for example, a poorly conducted training session, the instructor being late, or the reception staff making mistakes [1]. Moreover, more often than not, it is generally impossible to objectively demonstrate to the client whether the service is good or not until the moment, it is provided. Based on the above, certain conclusions can be drawn.

Firstly, a fitness service, like any other service, is intangible and intangible until the moment of its acquisition. In addition, in order for the client to take his word for it, service providers try to formalize the most significant service parameters for the buyer and present them as clearly as possible. In the fitness industry, this can be done with the help of a stylish and impressive design of a fitness club, high-quality service, modern equipment and new exercise equipment, highly qualified instructors, and so on. Because the intangibility of a service increases the risk of uncertainty when purchasing it, consumers listen more to other people's evaluations of the service than to advertising messages paid for by the service provider [2].

Therefore, the service provider (in our case, a fitness club) must stimulate the maintenance of a positive public opinion by directing its marketing efforts to influencers (trying to awaken in them a desire to use the services of a sports and fitness center) and satisfied customers (so that they recommend the fitness club to their colleagues, friends and relatives).

Secondly, services are inseparable from the sources (specific workers) providing them. Any replacement of a trainer, instructor in a gym or aerobic gym can change the process and result of providing fitness services, and, consequently, change demand. Thus, both clients and sellers of fitness services influence the result of service [3].

Third, services are inconsistent in quality. This is due, first, to their inseparability from the performing subjects (the result of a fitness service even depends on the mood of the master), as well as to the impossibility and impracticality of defining strict standards for the processes and results of service provision. Nevertheless, service organizations, including fitness clubs, are trying to take various quality control measures. First, this is a careful selection and training of personnel [2]. In addition, it is possible to increase the motivation of employees by using incentives directly related to the quality of services. For this purpose, bonuses are introduced, such as “employee of the month”, or various bonuses depending on customer reviews.

Fourth, services are not preserved. This means that it is impossible to prepare services in full in advance and store them as tangible goods in anticipation of an increase in demand. For example, if no one comes to a yoga class held in a fitness center, then the service simply disappears. As a rule, sports and health clubs encounter this kind of difficulties during the daytime, when the number of visitors is small. Moreover, during peak hours, that is, in the morning and evening, the situation is opposite: many clients cannot get to classes because the groups are overcrowded. To cope with these difficulties, many fitness centers use a price differentiation strategy that allows them to regulate demand, or rather reduce it during peak periods [4].

Marketing of fitness services is based on the general concept of marketing, since the modern service market offers the physical culture and sports industry a mechanism through which their commercialization is

carried out. Marketing includes analysis, planning, implementation and control of activities aimed at establishing profitable exchanges with target markets to achieve the goals of the fitness club.

The introduction of innovations into the daily activities of fitness clubs occurs according to a certain algorithm, which includes a number of preparatory and executive stages associated with the development and implementation of this business project. For this purpose, a business plan is drawn up, which is a comprehensive program that contains economic, technical, organizational measures, as well as provides forecast estimates and the necessary justification for the implementation of this project in practice [5].

Marketing management in the fitness industry is all about demand management. Demand is a social need for various services, a form of manifestation of need in the services market. The growing demand for fitness services entails an increase in supply. In this case, the winners are those market participants whose offers correspond to the basic preferences of the consumer. Speaking about consumer preferences, it is worth noting that some of the main criteria when choosing a fitness club are its location, pricing policy and range of services provided.

Let us look at the main reputation management tools used by fitness clubs in their daily activities.

Creating an attractive image for a fitness club through the fame and popularity of its employees and clients. High authority, fame and glory of the fitness club staff and its clientele play a huge role in the formation of reputation and good name.

Using expert reviews and media publications. Many fitness club websites contain corresponding sections called “Press about us” or “Publications”, where excerpts or full texts of articles and reviews on the fitness industry are given, and where the brands of these clubs are mentioned in a favorable context.

Use of specialized ratings. A high place in the ranking compiled by a group of independent experts raises the business reputation of a fitness club among clients, partners and its own staff, and creates a basis for quantitative assessment of the most important parameters of the fitness business [6].

Conducting all kinds of competitions. The practice of running a modern fitness business shows that providing only high-quality services to club clients is not enough. It is necessary to arouse interest among consumers, create proper motivation for classes, for communication with staff and with each other. Such interest and communication are greatly facilitated by competitions held in a variety of areas and forms.

Comparison of training results according to the “before” and “after” criteria. Significant parts of clients come to fitness clubs with the goal of improving their figure and getting rid of excess weight. The motive of improving health and increasing physical activity is also important. By systematically measuring anthropological indicators and health status, clients have visible results of their exercises - photographs “before” and “after” of a certain stage of exercise, weight loss, muscle building, correction of body shape, posture, flexibility, endurance, strength.

The leading factor in the competitiveness of fitness industry enterprises is price. The cost of services provided to consumers determines the number of client groups, cash flow, profit and profitability of the fitness club. Price is a complex, integral indicator that includes a lot of other parameters of the economic activity of a fitness club. In particular, the price for fitness services includes:

– Production costs (including employee wages and investment costs);

– The profit margin of the fitness club or each individual service;

– Prestige and business reputation of the club;

– Personnel qualifications;

– Payment method for fitness services;

– Successful or unsuccessful location of the fitness club and some other parameters [3].

There are a number of other reputation management tools. These, in particular, include holding open days, press conferences, and corporate evenings for clients, fitness conventions, allocating places for fitness classes for children, the disabled, and much more.

All these events brought to the attention of the public through the media or otherwise, contribute to the formation of a good name for the fitness club. It is impeccable business reputation, which has high moral and economic significance. Increasing awareness of the club's brand and increasing the number of client groups is the main result that fitness business organizers expect to receive from the advertising campaign. Fitness clubs widely use various types of advertising in their commercial activities, influencing different target groups in a variety of ways.

Most often, advertising for fitness clubs appeals to aesthetic feelings, leadership, energy, economy, prestige, the joy of communication, and changes in life. Advertising stories and messages use, for the most part, approaches based on sexuality, attractiveness, life success, longevity, spiritual and physical health [7].

The fitness center needs to sell other services besides cards. This could be personal training, solarium, cosmetologist services. The presence of additional services will increase the throughput of the fitness center per unit of time and increase the turnover.

To summarize, we note that the main marketing technologies used in the fitness industry are analysis and forecasting of the state and development of the target market for health services. Identifying the needs of target groups for sports and recreational services; creating and ensuring flexible maneuvering in the field of pricing policy for services and goods; organization of work of fitness clubs; advertising, public relations. When applied, marketing technologies allow a company to achieve profitability and efficiency in the market through planning, organizing work, analyzing and monitoring the results of the company’s market activities, its competitors and the market situation.

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MEDICAL SCIENCES

FAMOUS DOCTORS OF THE ANCIENT EAST AND AZERBAIJAN

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DOI: 10.5281/zenodo.10132570

Abstract

People living in Azerbaijan several thousand years ago already had medical knowledge, and this stage was developing in an upward trend. This rise, which was founded in the VIII-IX centuries, lasted until the end of the XIV century. Ancient East and Azerbaijani doctors Abu Mansur Muwaffaq, Abu Sahl Masihi Jurjani, /Ibn Sina's teacher/, Ibn Sina, Ibrahim Ibn-Ali-Najjar-Khagani Shirvani, Abu Nasr al-Farabi, Muhammad Zakariya-ar-Razi, Abu Reyhan Biruni, Kafiyaddin Omar Osman oglu, Isa al-Raqqi Tiflis, Muhammad Yusif Shirvani, Murtuza Gulu khan Shamlu fluent in Arabic and Persian, visited, studied and worked in various cities of the Caliphate, such as Baghdad, Damascus and Cairo.

Keywords: doctor, medicinal plants, pharmacology, drugs, historical source, manuscript.

It is no exaggeration to say that in the tenth and fourteenth centuries, the Islamic world was the pinnacle of human civilization. The largest universities, observatories, hospitals, pharmacies and libraries were located in the Muslim East, where the most powerful scientists worked.

During this period, madrasas operated under large mosques in Azerbaijani cities. These madrassas taught Arabic and Persian languages, Arabic grammar, logic (religious dogma), jurisprudence (Islamic law), mathematics, calligraphy (calligraphy), history and eternity. Greek philosophy, astrology, logic, public speaking, geometry, medicine, alchemy, and other subjects were taught in large madrassas, similar to modern universities. The children of the landowners and the clergy read here.

Azerbaijani doctors, fluent in Arabic and Persian, visited, studied and worked in various cities of the Caliphate, such as Baghdad, Damascus and Cairo. Books by foreign authors also found their way to Azerbaijan.

During this period, the pharmacological encyclopedia of Abu Osman Muwaffaq al-Haravi was distributed in Azerbaijan. Although Abu Osman lived and worked in the 10th century in the Iranian province of Herat, his books were popular throughout the Muslim East, including Azerbaijan. In order to gather information about medicinal plants, Abu Uthman traveled all over the world and got acquainted with the medical traditions of many peoples, including Azerbaijanis.

One of the first researchers in the field of pharmacology and pharmacology, Abu Mansur Muwaffaq, a prominent physician, pharmacologist and pharmacologist of the 10th century, probably came from Northern Azerbaijan and wrote the first book of pharmacology in 980.

The "Scientific Work on the Fundamentals of Pharmacology" written by Mivaffag or Abu Mansur in the late tenth century is noteworthy. This work is important as a source of information on chemical knowledge, the development of methods for the preparation of preparations containing plant extracts. The scientific work shows simple methods for obtaining essential oil and distilled water. Also, chemical compounds are prepared - cinnabar and suleiman for the treatment of skin diseases; copper sulfate for the treatment of eye diseases; natural soda in plant powder as an astringent and blood-stopping agent, alkalinization of carbonate during consumption, astringency, natural borax used as a medicine under the name of "nushdar", nashatir, and finally oxide, and especially zinc sulfate used by the Arabs in the treatment of eye diseases. Later, Abu Mansur described the characteristics of gypsum and arsenic, antimony, iron, clay, copper, lead, gold, silver, oil, resin, camphor, starch, kamed, soap-based oils, etc., in simple form and in hardened form. showed. The book also tells about the ancient means of fras - ointments from mercury and alkane. Abu Mansur also mentions the use of some organic acids in medicine, such as corn sugar and tannins.

Abu Mansur's book explains the effects of 446 herbal and 44 animal medicines.

Before writing the book, the author traveled to Iran and India, studied the drugs used for treatment, and noted that he encountered many difficulties here.

The author shows that the effect of drugs depends on the individual characteristics of the body, ie the body's heat, cold, dryness and humidity. He noted that the effect of drugs on the body goes in three stages: during the circulation of the drug after taking it and when it is eliminated from the body. Therefore, when a doctor prescribes a drug to a patient, he must determine these characteristics, as well as the taste of the patient, the drug and the diet, and monitor the effect of the drug. He gave strange explanations about the effects and use of drugs. For example, he put forward ideas about toxic drugs, poisons, opium (a form of medicine), their preparation and use.

He expressed unimaginable opinions about the quality of medicines, food, food and medicine at that time. The same drug can have different effects on the same patients. Therefore, treatment should be carried out individually.

Ali Asadi systematized Abu Mansur's book on pharmacology in the 11th century and translated it from Arabic into Persian.

Abu Mansur suggested very interesting ways of injecting drugs into the body: eating, drinking, rubbing, wet, dry, blowing, tampons, wicks, etc. Here he paid special attention to the treatment of asthma, skin and prostate diseases.

Abu Mansur considered it necessary for a person to be his own doctor. He said that a person can determine the cause of changes in the body by observing the individual characteristics of his body.

Abu Mansur's book on pharmacology was published in 1892 in Derpt in German. The translator and author of this book was the Azerbaijani doctor Mirza Abdulkhalig Akhundov. According to this publication, he received the title of Doctor of Medicine. A brief copy of the book was written in Persian in 447 AH, 1055 AD and is now housed in the Vienna Library.

Akhundov Abdulkhalig Haji Abdulla oglu was born in 1866 in Baku. After graduating from high school in Baku, he entered the medical faculty of the University of Derpt / Tartu / and graduated with honors from the Department of Ophthalmology.

Later, at his father's request, he went to Germany to study medicine at the University of Erlanger and received a diploma in psychiatry. Over the years, he has mastered ancient Greek, Latin, German, French, Russian, French, and Arabic.

Returning to Baku at the end of the 19th century, Abdulkhalig Akhundov is actively involved in socio-political and cultural spheres. Creates a library, publishing house. Participates in the enthusiastic activities of Baku intellectuals.

What is the healing effect of music? The famous Central Asian Turkish scholar Abu Nasr al-Farabi (873-950), who has encyclopedic knowledge, states in his book "The Great Book of Music": "Music promotes the improvement of mood, moral education, restraint and spiritual development. It is also good for the physical health of the person, because when the body is sick, the spirit is also weakened. Music, which has a positive effect on the human senses, improves mood and restores health to the body.

At that time, doctors were trained in mosques, madrassas, secondary schools, and universities in Azerbaijan. While training specialists in these schools, special attention was paid to their formation as individuals. They taught education, science and helm, that is, deontology, the rules of ethical conduct. Therefore, clergymen, doctors, philosophers, historians, architects, mathematicians, writers and other specialists were honorable in fulfilling their artistic and civic duties in their fields, being knowledgeable, scientific, healthy and humble. Their names were also mentioned with honor. It is no coincidence that the doctor, the judge and the philosopher were popularly called "doctors". The reason for this is the release of people from former scientists and doctors,

The IX-XII centuries are a period when medical science was especially formed and developed. Famous medical figure, philosopher Muhammad Zakariya-ar-Razi / Arabic /, Abu Mansur Muwaffaq / Azerbaijani /, Abu Reyhan Biruni, Abu Sahl Masihi Jurjani, / Ibn Sina's teacher /, Abu Ali ibn Sina / Tajik 980-1037 /, Omar Osman oglu / Azerbaijani / and so on.

The IX-XII centuries AD were the period of formation of medical science in the east. One of the prominent scholars of this period was Abu al-Hasan Ali Rabbani al-Taabari, who lived in the early ninth century. The author used Greek and Oriental literature to write the book "Firdovsi-ul-Hikmat" in Arabic (236 h 850 m.).

One of these personalities is Ali ibn Abbas Majusi Ahwazi / 994 /. This scientist is the author of the book "Kamil ul-sanat tibb".

Another of these eminent scholars was Abu Sahl Masihi Jurjani Isa ibn Yahya, the teacher of Ibn Sina (died in 1003).

The genius Abu Ali Ibn Sina (980-1037) also visited Azerbaijan many times and collected medical information from there. He tells about his visit to Saburkhast settlement of Azerbaijan in his work “Qanun fith-tibb” (“Laws of Medicine”). Ibn Sina lived for a long time in the city of Hamadan on the borders of Azerbaijan, where he wrote most of the "Laws of Medicine".

Abulqasim Zahravi's (died in 1013) book "Surgery and Instruments" is a valuable example of art that has survived to this day.

In Europe he was known as Abulcasis. The work contains images of surgical instruments developed 1,000 years ago. It is included in the UNESCO Memory of the World list

Dastur-ul-Alaj, which occupies a special place in the medical literary heritage of the East, is one of the most important books on treatment. H 993, m Written in 1526 by Sultan Ali Khorasani.

The author writes, “I have been practicing medicine in Khorasan, Samarkand and Mavarannahr for more than 40 years. At that time, I was working with Dr. Abu Mansur Gucgu. The disease has spread in the country. Abu Mazaffar Mahmud Shah invited me and ordered me to write a book on medicine. "

The author mentions that he has used many books and adds his own experience.

The book discusses the role of the pulse in treatment methods and the crisis that occurs during the course of the disease - the crisis. The introduction of the book deals with hygiene, ie the scientific and practical tasks of medicine.

There are also written about diseases of the body, their symptoms - symptoms and prescriptions for treatment.

In addition, the source of energy of the air and a necessary factor of life, the relationship between spirit and body, the effects of seasons, temperature on health and physical activity, cities, places of residence, housing hygiene, seasonal clothing, food hygiene. It also explains the efficient use of water and water, the prohibition of wine and its use, and the serious consequences of overuse, sleep patterns, and the benefits of exercise. The rules of administration, emetic drugs and their use, bleeding and hemorrhage are indicated.

Mental and psychological states - information about the effects of pleasure, peace of mind, fear, shame, thoughts, anger, hope and despair on the body.

One of the prominent scientists of Azerbaijan was the uncle of our famous poet Ibrahim Ibn-Ali-Najjar-Khagani Shirvani, the great organizer of science and health, doctor Kafiyaddin Omar Osman oglu. The successor of Ibn Sina's school, Kafiyaddin was also a great philosopher, mathematician, astronomer and chemist.

Umar ibn Usman Kafiaddin is by origin the most famous doctor-scientist among the Azerbaijani Turks. In Shamakhi, he created and operated a health house there, from where his fame spread throughout the East.

About Omar Kafiaddin 1080 - in Shirvan, the capital of Shamakhia, it is believed that he was born in this city. He was one of the most outstanding personalities of his time, and his fame as an Azerbaijani scientist spread everywhere. Kafiaddin was a highly educated person. He knew several languages, was well versed in philosophy, theology, astronomy, mathematics, medicine, chemistry and pharmacology, and taught at a madrasah. Khakani wrote about him: “If my uncle does not leave me, no devil can lead me astray. He is a man of culture and science. As water rises in height under the influence of the sun, so I have risen thanks to it. , is the Arastun of his time.”

It is said that before establishing his own healing center, Omar Kafiaddin instructed his students to slaughter several sheep and hang them around Shamakhi. A week later, Kafiaddin drove through these places one by one and saw that the corpses were damaged everywhere. The meat hung in a place called Birja Melhem remained as if it had just been butchered. From this Kafiaddin concludes that the air in the ointment is not only very clean, but also has a healing value. Therefore, he decided to establish his medical academy here.

And now this place is called Mazyu. Azerbaijani scientist N.K. Karamov believes that the name of this place comes from the word "ointment" in our language - a valuable medicine. There is another version about the origin of the name of this place. There is a legend that a doctor lived in the vicinity of Shamakhi, who once treated skin diseases with a miraculous ointment, and the place later received the name “Mazh”. Kafiaddin invites medical scientists to work here, involved in treatment, drug production and medical education. He was an excellent doctor, surgeon and pharmacist. Like other similar establishments in the Middle East, his hospital had a pharmacy. Doctors, pharmacologists and pharmacists of various specialties also lived here. At the same time, recruits, full-time doctors and pharmacists, including "surgeons".

In the treatment centers of that time, the corridor system of buildings was usually applied. There were reception and procedure rooms at the entrance, wards on either side of the corridor, and finally a morgue at the end of the clinic. The main building was connected to the farm building by an open balcony. The balcony improved air conditioning in the building and was used as a ward when needed. A small pharmacy was located a short distance from the main building. Nearby, houses for doctors and servants were built, as well as a large pharmacy. The pharmacy went to the garden, where various plants were planted to prepare medicines. According to MA Akhundov, "The Academy used molds for the treatment of various internal and external diseases. Up to 17 types of these fungi were distinguished: bread mold, milk mold, confectionery mold, honey mold, etc."

Omar Osman oglu taught his students moral purity, patriotism, and service to the people, just as he was demanding of himself: "You do good to the people, even if you hurt yourself," "Do not be selfish," and so on.

He adhered to the ideas of the East, such as "Man must be his doctor," "He must study his body well," and he himself repeated it. At the same time, he said, “Medicine has a cure for all ailments, but doctors do not know all of them. Take care of yourself, don't trust the doctor. "

Omar Osman oglu considered the brain to be the center of life activity and showed that the body's balance, memory and cognition depend on its condition.

Omar Osman oglu was also a great pharmacist. His extensive arsenal of medicines included animal, mineral and herbal medicines. He also made extensive use of diet, physiotherapy, and organ therapy.

Omar Osmanoglu's methods of treatment were in line with his views when the disease occurred in the 11th century. He believed that in case of malnutrition and overeating, the culture should be cleaned and vomited. In this case, he preferred sour milk taken during heating. He treated heart disease with honey, syrup, sweet wine and fruit juices. During kidney disease, he ate boiled borax and root with honey and grape juice. Omar Osmanoglu also used organ therapy: he treated his grandfather with hedgehog oil for oral administration, he used crushed animal bone powder for joint pain, and for mild diseases he used animal brain powder, egg yolk and "fodder" grass collected early in the morning. has done.

Kafiaddin's son Vahidaddin Osman is also a great help in his activity. Osman was a good doctor, surgeon and pharmacist with encyclopedic knowledge. He was also known as a perfect philosopher, theologian and poet. He was also a talented musician and musicologist. He was well versed in music theory and played the erkan, the father of the modern argan. Osman Xaqani He also took an active part in his upbringing. It is not ruled out that the poet received his musical education from Osman.

Umar ibn Uthman Kafiaddin1150 died in and Shamakhi. He was buried with great reverence. Here, in the hot mountains under the constant rays of the sun, among the tall trees, juicy grasses and abundant water springs, patients could be healed without a doctor. Later, this place turns into a flea. The people, who sincerely believed in the sanctity of these places and the scientist buried here, came here to worship and offer sacrifices. The name "Dada Gunesh" is derived from the name "Dada" given to Kafiaddin among the people. At the same time, there is a saying among the people used to warn people against weeds, which also mentions Kafiaddin Dada: "Do not play with this grass like Dada. It is poisonous, let the horse go." Khagani lamented Kafiaddin's death:

Oh! Gone is the philosopher of this world,

The meaning that opened the door of heaven went, alas!

In addition to medical sources, there is extensive information about mental illness in oral folk medicine, folklore, and in the pages of the literary heritage of poets and ashugs, great thinkers.

Mental deficiency in the Azerbaijani language is defined by many words: crazy, insane, depraved, rabid, hot, key, crazy, stupid, stupid, stupid, stupid, stupid, stupid, and so on. The people of Azerbaijan treat such patients with patience and care.

The first work reflecting the state of medicine in Azerbaijan was "Medicine" by Isa al-Raqqi Tiflis. Isa al-Raqqi was a representative of the empirical direction. For him, experience is a "powerful factor" that solves everything, theoretical discussion is abstraction, "experience is creation, abstract judgment is destruction." Jesus al-Raqqi opposed the theories of the existence of the soul. According to him, the organism is a whole living being, and the disruption of one part leads to the disruption of the whole organism. Here you can determine your health and illness.

As a remedy, Isa al-Raqqi recommended a variety of foods, herbs and minerals. For example, in the case of kidney and intestinal diseases, he treated it with very sweet remedies: honey, grapes, fruits, sweet pomegranate. In gastrointestinal diseases, a diet was maintained to cleanse the stomach. He also used sour milk, grape leaves (for skin diseases), cherry jam for sore throats, and opium "when nature is disturbed."

While traveling to many countries, Isa-ur-Raqi became acquainted with their medical problems, and in addition to translating many works, he enriched them with his science and experience.

In his writings, Isa-ur-Raqi showed that experience is the decisive factor.

He recommended the devastating effects of bad habits and the need to avoid them: "If every body could not accept bad habits, it would not be addicted to them, so it cannot give up bad habits (drugs, alcohol, cigarettes, etc.)."

Among the good customs, Jesus-ur-Raqqi meant food, rest, movement, cleanliness, tidiness, restraint and patience in his time. They must be obtained as a result of the study of past experience, the mysteries of nature, their theoretical verification and analysis. Therefore, the heritage of medicine and pharmacology should be studied at the level of these principles and modern understanding. It should also be noted that the origin, development, emblem, and foundation of medicine and medicine are the same, and the common goal is to heal. Nevertheless, as a result of the development of these sciences and arts and the expansion of their fields of activity, medicine and pharmacology began to develop as independent fields of science and art in 754, with the aim of uniting them with action forever.

The development of modern medicine and the production of hundreds of new effective drugs should not prevent us from studying the great heritage of Eastern medicine. Serious complications and drug diseases, especially those caused by chemical drugs, lead us to relearn Oriental medicine. The history of pharmacology consists of studying and applying its rich experience, as well as the totality of human knowledge and experience in the fight against diseases and their prevention.

This should be done by pharmacists who are committed to their art. It also depends on the art, effort and diligence of pharmacists.

According to religious law, medicine is a field of science and art that works to ensure the physical and mental health of people.

It is well-known that when a person is physically ill, he also suffers spiritually. When you are mentally ill, the normal functioning of the body is disrupted, and the person becomes mentally and physically anxious. Therefore, a doctor can become a doctor only if he can feel the patient's pain, determine the cause of his illness and his taste, prescribe the right treatment, gain the patient's trust, and not disturb the patient-doctor relationship. The doctor's task is to heal the patient and be able to enjoy him spiritually. Therefore, a doctor must know both medical and religious sciences, he must have a deep philosophical outlook, and a doctor must be wise and humble, as well as a wise psychologist. As a true master of his art, he must be able to approach the patient individually. He must be able to understand not only the mood of the patient, but also the mood of those around him. Because a relative, especially those who serve the patient are mentally and physically disturbed. It is no coincidence that the late Fuzuli said the following about those who served the patient:

"Service to the patient who sees, in the end he became ill"

The physician and pharmacist must fear God and memorize the Hippocratic oath, repeat it daily, and observe it. After prescribing treatment to a patient, the doctor should monitor the progress of the disease, because the same disease does not go the same way in all people.

Most of the physicians involved in the treatment, as well as the attars, were engaged in the collection and drying of medicinal plants with their students. Doctors sent copies of prescription drugs to pharmacies and prepared them there.

In the past, there were attar pharmacies in most cities and villages of Azerbaijan. For example, Shamakhi, Shusha, Ganja, Aghdam, Nakhchivan, Lahij, Ordubad, Salyan, Lankaran and others. These pharmacies had a wide range of herbs and spices. For example, in the attar pharmacy of Mirbaba Mir Abdulla oglu, the father of Yusif Vazir Chamanzaminli, more than a hundred of the 142 medicines were herbs.

However, currently 5-6 green pharmacies operating in the country do not have 20-25 such medicinal plants. However, in the pages of medical literature of that time, including Mirza Mehdi Naqtash Ganjavi's / 1791 / book "Garabaddin", hundreds of drug names were included in 74 drug forms. Among them are anushdaru, paste, cuvarish, torture, vodka, zimad, pills, ointment, hakna, ayaraj and others. can be shown. However, currently the number of dosage forms does not exceed 20. The words "May God heal" were written in the recipes as "Huvallahu shafa".

Mansur ibn Muhammad ibn Yusif ibn Ilyas, one of the great Azerbaijani scholars, was born in Tabriz in

the 14th century, later moved to Shiraz and worked there for a long time. and the author of other valuable books. He described thousands of herbs and other natural remedies and various treatments. This scientist became famous in Iran and other Eastern countries.

In the works of Mansur ibn Muhammad ibn Yusuf ibn Ilyas, there is a special chapter in his book "Medicine" ("Medicine", 1436) entitled "Rules for the preparation of medicines." He was a supporter of the rule that in the treatment of the disease it is necessary to treat the body with general strengthening agents, directly affecting the diseased organ. In his comments, the scientist pointed out the occupational diseases of nomads, painters, doctors, weavers and advised them to follow the rules of hygiene for the above professions. He advised painters, leather gloves and wooden spoons to mix, leather carvings for nomads, and always drank buttermilk after lime work. In the technology of preparation of medicines, Mahmud described the uselessness and incompatibility of the preparation of reciprocal neutralizing agents: vinegar-milk, acid-alkali, etc. With the exception of some notes on its harmfulness, it has not introduced any innovations.

Oral folk medicine (Turkish remedies) has a special place in Azerbaijan.

Among the books on medicine, works on medicine have a special place. Of these, the book "Makhzan-ul-Adviyya" (Treasure of Medicines) by Mohammad Hussein Alavi, which is of great scientific and practical importance / 1032 pages, date of writing 1771 / was republished in India in 1888. In writing this work, the author used the works of medieval medicine and the works of Ibn Sina, Ibn Baytar, Sheikh Yusuf Baghdadi, Sheikh Dawud, Abu Rayhan Biruni and others, as well as the ancestors of the physician's descendants.

The second authoritative "Garabadin" is the work of Muzaffariddin Ibn Ahmad Ibn Hussein al-Shafa'i.

The third work "Garabadin" is a book written by Mirza Mehdi Naqtash Ganjavi skillfully and creatively based on the work of Shafai / in 1786 /. These books show 74 forms of medicine and their different types, more than 1000 prescriptions and in what diseases they are used. There is no doubt that the analysis and application of these works at the level of modern understanding will have a great social and economic effect.

In the 13th century, there were geniuses and other doctors of Azerbaijan, such as Ibn Kabir Khoi, Muhammad Ibn Namvar Tabrizi. Recent research shows that 724 species of medicinal plants are described in medieval Azerbaijani manuscripts. Many of them have already been forgotten by modern medical science.

The works of Ramadan ibn Sheikh Ali Lan-Karani (late 13th century) were noteworthy. In one of them, in the work "Far-ruh-name Jamali" (1409), the author spoke about the healing properties of organic and inorganic drugs, showed the therapeutic quality of milk, brain and stomach. Azerbaijan at the service of this authordiscovery of therapeutic mud and determination of the healing properties of Azerbaijani clay - gialba.

One of the valuable examples of the Middle Ages is the Tohfat-ul-Mu'min - / contribution to the believers / 1277 h. / 1863m. It was written by Mahammadali Tehrani and published in Dar al-Khilafah in Tehran. The author shows that Akhund Mola Ali and Seyid Hussein Isfahanni helped him to write the book. He also mentions the authors who wrote before him in Persian and Arabic: Shaykh-ur-Ra'is, Ibn-Ashdas, Abu Hanifa, Yahya Ibn Chozla, Jarjas Ibn Yuhanna, Sayaf, Amin al-Dawla, Ibn Talmin, Ibn Baytar, Sheikh David,shows doctor Ali Gilani.

Gives information about the essence, effect, dosage of spices - in snake and scorpion stings: it means to squeeze, scratch, suck and burn a living area, for example, and sometimes to cut that area. The book provides information on weight units.It is a drug used to treat various diseases of the body.

In the Elkhanid state established in the XIII-XIV centuries, science reached very high peaks. The flourishing of medical science in Azerbaijan dates back to the XIII-XIV centuries. Most likely, it was during this period that reflexology (acupuncture and staining) began to spread in Azerbaijani medicine. Remains of this ancient method of treatment still live under the name "childak".

Azerbaijani scholar Najmaddin Ahmad Nakhchivani wrote comments and borders on Ibn Sina's works on medicine and philosophy. Nakhchivani Najmaddin ibn Ahmad ibn Abubakr ibn Muhammad (born in Nakhchivan, died in 1253 in Aleppo, Syria) - a well-known Azerbaijani philosopher in the Muslim East, studied in Nakhchivan, perfectly studied all areas of science. He lived part of his life in Azerbaijan and worked at the Maragha Observatory. The Arab scholar Ibn al-Ibri (Abu-1 Faraj; 1226-1286) wrote about Nakhchivani in his "A Brief History of the States" ("A Brief History of the States"): was engaged in philosophy. "Nakhchivan had to leave his homeland, probably due to political circumstances. The philosopher, who was the vizier of Amir Jalaleddin Garatay for a while, could not remain indifferent to the socio-political events around him when he witnessed injustice in the upper circles. He left the palace life as a sign of protest and went to Aleppo. Ibn al-Ibri writes:

"He traveled his countries, traveled a lot, and finally came to Rome, where he held senior positions."

The scientific and philosophical creativity of Nakhchivani was highly appreciated by medieval authors. The Arabic author Ibn Bibi likened it to "a rippling sea and a rainy cloud in all sciences and disciplines" and noted that it contained religious and secular sciences. Nakhchivani studied the problems of peripatetic philosophy in depth and attached great importance to logic and natural science. Despite being considered an active promoter of the works of Ibn Sina, a prominent representative of Arabic-speaking peripateticism, he critically examined a number of doctrines. Nakhchivani wrote commentaries on Ibn Sina's books "Law of Medicine" and "Signs and Notes". Unlike the Eastern peripatetics, Nakhchivani, who believed in the existence of the soul after death, "had a strong tendency to the doctrine of sexuality," according to the sources. . He did not examine Ibn Sina's works from the point of view of orthodox Islam, but criticized the peripatetics by accepting a doctrine that did not conform to the principles of the ruling ideology. Manuscripts of his works are in

various archives around the world, including a commentary on the book "Law of Medicine" in the National Library of Paris, a commentary on the book "Signs and Notes" in the Turkish Hagia Sophia, Nur Ottoman and Bridge libraries, "The essence of logic and a summary of philosophy" in Najaf, Iraq. -Mashhad al-Alvin is kept in the manuscript fund.

The famous doctor Abu Abdullah Muhammad Ibn Namwar Tabrizi (1194-1245), who lived and created in the city of Tabriz, is the author of the work "Advarul-hammiyyat" ("The most important medicines").

Another doctor, Yusif Ibn Ismail Khoi, better known as Ibn Kabir, was one of the most prominent pharmacists in Azerbaijan and the Muslim East in general. His Jamei-Baghdadi (Baghdad Collection), written in 1311, was considered one of the most complete works on medicine in the whole East. He was one of the most famous pharmacists of the XIII-XIV centuries. He was born in Khoy, South Azerbaijan, where he studied medicine, and later moved to Baghdad, where he became a court physician for the caliphs. In 1311, Yusuf ibn Ismail wrote a pharmaceutical encyclopedia called "Jamei-Baghdadi" ("Baghdad Collection"), which became famous throughout the East. The book covers several thousand medicinal plants, minerals and animals used in medicine.

Scientists from Nasreddin Tusi's scientific school have also created a number of important medical works. One of these scholars is Abdulmajid Tabib. In about 1275-1280, he wrote the book Kitab al-Mudawat. In addition to psychiatry, neurology, sexopathology, the book examines many other topics of medicine.

During the Safavids, a number of prominent doctors grew up in Azerbaijan. Yusif Garabaghi emigrated from Azerbaijan in the 17th century and lived in Samarkand, where he taught in a madrasah. He wrote commentaries and margins on Ibn Sina's Qanun. The people of Samarkand called him "Great Akhund" as a sign of respect.

Murtuza Gulu khan Shamlu was known as a specialist in sexually transmitted diseases. In addition to being a scientist and doctor, he was the governor of Ardabil (1678) and one of the Safavid emirs.

The activity of Muhammad Momin (died 1697), originally from Mazandaran, was also connected with Azerbaijan. He was a court physician of Shah Suleiman the Magnificent and created an encyclopedia of medicine and pharmacy called "Tohfatul-Mumin" ("Contribution of Believers", 1669) by order of the Shah.

During this period, the works of a number of Central Asian, Persian and Arabic authors became famous in Azerbaijan. The following works were the desktop books of Azerbaijani doctors: Ali Ansari (Haji Zeynalabdin Attar) “Ikhtiyarati-badii” (XIV century), Yusif Ibn Muhammad Haravi “Jamul-fawaid” or “Tibbi-Yusifi” (1511), Mansur Ibn Muhammad “Kifayatul-mujahida” or “Kifayeyi-mansuriyya” (1423), Sultan Ali Khorasani “Dusturul-alaj” (XVI century), Sayyid Mir Muhammad Momin “Tohfatul-mu’minin” (1669), Muzaffar Ibn Muhammad Hussein Shafai “Garabadin »(XVII century), Muhammad Ibn Ali Naghi“ Zadul-musafirin ”(XVIII century), Muhammad Hussein khan Alavi Samarkandi“ Makhzanul-adviyya ”and“ Garabadini-Kabir ”(1777) and others.

A number of medical works of Ottoman Turks also found their way to Azerbaijan. Some of them are now kept in the Institute of Manuscripts of ANAS: Dervish Nidai “Manafaun-nas” (XV century), Mohammad Raisul-Atibba “Unumuzajut-tibb” (XVII century), Mustafa Feyzi “Risaleyi-ginagina” (XVIII century) and others. One of the manuscripts of Manafeun-nas was copied by the Azerbaijani secretary Mohammad Attar Salyani in the 19th century. There is also a copy of "Tibbname" from the period of the Ottoman Sultan Murad, copied by Muhammad Yusif Shirvani in 1711/2. The book was written in Ottoman Turkish and deals with the treatment of most diseases known at that time.

At the end of the 17th century, Haji Suleiman ibn Suleiman Arivani's Fevand uo-Hikmat appeared. Here the names of medicines are written in different languages - Azerbaijani, Arabic, Persian, Greek. The author indicates the load limit used in the preparation of medicines:

1 rhythm is equal to 90 mica or 360 grams;

1 men is equal to 180 mica or 720 grams;

1 miskal is equal to 4 grams (in Ibn Sina's Qanun, miskal is equal to 4.25 grams).

In addition to plant, mineral and animal products, Azerbaijani folk medicine has applied water and mud treatments, oil and sun treatments, and massage.

Arivani divided the drugs into categories: the first category included a certain amount of substances that do not cause changes in people with moderate hyperactivity. The second category includes substances whose effects are clearly observed. The substances were "harmful" in the third degree, but did not have a dangerous effect. The latter effects are specific to substances belonging to the fourth degree.

In practice and in comparison, Azerbaijani pharmacists have identified the properties of medicines. According to them, the experiment should be carried out on young and healthy people with moderate enthusiasm. The time of year and day were taken into account. It was recommended to repeat the experiment at different times of the year. It was necessary to prescribe the most appropriate number of drugs for treatment. The study needed to start with small doses and gradually increase them.

Among the experiments, the results of experiments on animals could be considered. At the same time, it should be borne in mind that the same substance from different animals could have different effects. It is also important to keep in mind that herbal remedies or the plant itself could have been a natural product for animals to eat, and that it could have had a powerful effect on humans if they had eaten them.

When determining the properties of any herbal remedy, the place where the plant was collected, the time of collection, and the condition of the plant (fresh, dried) must be taken into account. Herbal and animal medicines had to be stored for some time to prevent loss of properties. In this regard, it was always necessary to indicate the time of harvest of the plant and to know the duration of storage of plant raw materials.

Chapter XIII provides information on units of weight, and Chapter XIV provides information on celestial bodies. Chapter XVII is devoted to the definition of diseases, their definition, degrees, symptoms and treatment.

Pharmacist Mohammad Momun, who lived in the 17th century, has already given herbal extracts for the treatment of skin cancer (carcinoma). Modern research in the United States and Europe has confirmed that these ancient manuscripts are indeed effective. Recently, hypericum perforatum has been widely used in medicine in the United States. Doctors recommend it to treat mild forms of depression. In 2000 alone, $ 160 million worth of drugs were sold in the country. However, the anti-depressant effect of daziot was noted in medieval Azerbaijani medical manuscripts, in the works of Haji Shuleyman Iravani and Hasan Ibn Reza Shirvani in the XVIII century. These facts prove once again the wisdom and deep knowledge of our ancestors.

Hasan Ibn Reza Shirvani, who lived in Shamakhi in the 18th century, wrote Sirajut-tibb (The Lamp of Medicine). This book deals with hundreds of complex medicines (pills, candles, pastes, ointments, powders, etc.).

Haji Suleyman Gajar Iravani's work "Fawaidul-Hikmat" ("Benefits of Wisdom") is dedicated to pharmacology. It lists thousands of natural remedies and shows how to use them. Yerevan's manuscripts are preserved in Azerbaijan, Iran, Egypt and other countries.

The Garabadin (pharmacopoeia) written by Seyid Muhammad Hussein khan in 1185 AH and 1771 AD consists of 20 chapters.

Chapter 1 of the book states: Nutrition is essential for human survival, and food affects the soul as well as the human body. Writes about the importance of water in the digestion and absorption of food. At the same time it definitely explains the issues of food and poison.

Chapter III of the work deals with taste and its types, four main features of the human body - cold, heat, dryness, humidity and so on.

In the twentieth chapter, his grandfather, doctor Mir Mohammad Hashim, talks about Seyid Alavi khan and Mir Mohammad Hadi Alavi and others. The remaining 15 chapters of the book are devoted to medicine. While writing this book, he came across the manuscript of his grandfather Mir Mohammad Hashim (known as the doctor Mutamad ul-mulk Seyid Alavi khan). This manuscript shows that Mir Mohammad Hashim wanted to write "Garabadin", but the work was incomplete.

Among the hundreds of scientific, literary and medical manuscripts preserved at the Republican Institute of Manuscripts, the work "Tibbname" written by Muhammad Yusif Shirvani in 1124 AH and 1712 AD attracts attention. This manuscript consists of 114 pages and 120 sections.

Muhammad Yusif Shirvani is one of the famous scientists, doctors and calligraphers of Azerbaijan who lived in the late 17th and early 18th centuries. Muhammad Yusif Shirvani was born and raised in Shamakhi, where he studied medicine and studied medicine. He was a doctor under Lutfali bey, the butler of Shirvan beylerbey Huseyn khan. In 1711/2, Muhammad Yusif Shirvani copied the cover of the unknown work "Tibbname" and wrote an introduction, comments and explanations. Thanks to his service, this book has survived to the present day. "Tibbname" is one of the most important medieval medical works in the Turkish language. This book deals with the treatment of most diseases known at that time.

"Tibbname" was the first medieval medical work published in Azerbaijan in 1990 in the Cyrillic alphabet for a wide readership. The book was later translated into Russian and published in St. Petersburg. Tibbname is the first medieval source on medicine in Azerbaijan, published in Russia.

Muhammad Yusif Shirvani (1704-1813) in his work "Tibbi-noma" summed up the views existing in Azerbaijan up to that time. Compiled by the author in the Azerbaijani language "Dictionary of Oriental Medicine", "Norms of treatment in the works of well-known scientists, variousInformation on the therapeutic properties of drugs. Mohammad Yusif Shirvani used grape vinegar, small walnut juice, mustard, white lime, berries, garlic, mulberry leaves, black pepper, blackberry root, peas, ginger, sumac, pomegranate root, tarragon and other rose water. used ingredients. As a form of medicine, he used ores, decoctions, ointments, patches, pills, pastes.

The book gives a brief information about the diseases of all parts of the human body, treatment, drugs and their composition, preparation and effects.

As in the pages of Eastern medical literature, the book "Tibbname" says that when treating or giving medicine to patients, "with God's help he will be healed," "God heal."

The book notes that diseases and their treatment methods are often self-correcting. So, it would be good if today's doctors learn the treatments and methods of the past and use them at the level of modern understanding.

In the introduction to the book, Muhammad Yusuf called his work the Book of Wisdom. At the same time, he writes, “I worked as a doctor for Lutfali Bey, the master of Shirvan. After the ruler of Shirvan, Huseyn khan Lutfali bey, was arrested and sent to the Hormoz fortress in Dagestan, I fled in fear. I was in Baghdad and Azerbaijan for a while, then I went to Dagestan. While there, in the Terek fortress, I received the book Tibbname. I copied the whole book that will work one day. ” The real author of the book is not known, but he is considered to be the author of "Tibbname" because he became famous at the Republican Institute of Manuscripts under the name of Muhammad Yusif. The book provides information on headaches, malculia, epilepsy, insanity, dementia, unconsciousness, forgetfulness, nosebleeds, toothaches, colds, babasil, tuberculosis and other diseases, their treatment and medication.

The translation of a small part of the book "Law" by the invincible and humble teacher Ibn Sina into Azerbaijani by Efendi-zade Mukhtar Ismail oglu / Aghdashli /, the book "Gulshan-ul-Ilaj" in Persian written by Muhammad Tahir ibn Muzaddin in Agdash / h 1255 / m 1839- cu il / da wrote.

Mirza Kazim Tabrizi's book on medicine written in Agdash in 1254 / m 1839, etc. can be shown.

Originally written in 1775/6 by Abulhasan Maragayi, originally from the city of Maragha in South Azerbaijan, "Treatment-munfarida" ("The most perfect treatments") deals with the treatment of various diseases. The book provides detailed information on herbal, animal and mineral medicines and their therapeutic effects. At present, this work has been translated and republished at the Institute of Manuscripts named after Mohammad Fuzuli of ANAS.

In the 18th and 19th centuries, collections of hadiths on the sayings of the Prophet Muhammad and his Companions about medicine were compiled and copied in Azerbaijan. The name of these works was "Tibbi-Nabawi" ("Medical of the Prophet"). The Institute of Manuscripts keeps three different manuscripts of the Tibbi-Nabawi; One of them was transferred by an Azerbaijani secretary named Mohammad Bargushadi.

One of the medical works compiled in the Azerbaijani language in the XIX century is the anonymous book "Nuskhajat". Here are a number of recipes of folk medicine, as well as magic and prayers against various diseases. One of the famous doctors living at that time was Khurshudbanu Natava's palace doctor Mahammadgulu Gayibzade Garabaghi.

Beginning in the 19th century, the influence of European medicine began to be felt in Azerbaijan, and medical science entered a new stage.

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АНАЛИЗ СЛУЧАЕВ ВНЕБОЛЬНИЧНОЙ ПНЕВМОНИИ ПРИ КОРОНАВИРУСНОЙ ИНФЕКЦИИ ЗА ПЕРИОД ПАНДЕМИИ В 2020ГОД

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ANALYSIS OF CASES OF COMMUNITY-ACQUIRED PNEUMONIA IN CORONAVIRUS INFECTION DURING THE PANDEMIC PERIOD IN 2020

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DOI: 10.5281/zenodo.10132625

Аннотация

Основу исследования составила анализ поражения легких при COVID-19 и необходимости открытии дополнительных стационаров в Джалал-Абадской области в летний и осенний период подъема коронавирусной инфекции для оказания своевременной медицинской помощи больным. В стационаре оказали медицинская помощь больным, с диагнозом, COVID-19, вне больничная пневмония и другие пневмонии.

Abstract

The study was based on the analysis of lung damage in COVID-19 and the need to open additional hospitals in the Jalal-Abad region during the summer and autumn period of the rise of coronavirus infection to provide timely medical care to patients. The hospital provided medical care to patients diagnosed with COVID-19, community-acquired pneumonia and other pneumonia.

Ключевые слова: COVID-19, стационар, летний и осенний период, вне больничная пневмония, заболеваемость, регион, удельный весь, заболеваемость.

Keywords: COVID-19, hospital, summer and autumn period, community-acquired pneumonia, morbidity, region, specific whole, morbidity.

Введение. С началом пандемии коронавирусной инфекции, идет разнообразные исследовании, анализы, клинические испытании о новой коронавирусной инфекции. Хотя, мы видим уже более доказательные результаты о новой вирусной инфекции, таких как вакцинопрофилактики, методические рекомендации по лечению коронавирусной инфекции, чек листы для диагностики. Но проблема в том что, заболеваемость COVID-19 не утихло, мир боятся с друг друга, т.е. не установлено мирной, тихой жизни на земле. В связи с наличием мутации вирус [1,2]. Большую актуальность на фоне пандемии новой коронавирусной инфекции COVID-19, которая ассоциируется с высокой смертностью, ее основными причинами могут быть дыхательная недостаточность, острый респираторный дистресс-синдром (ОРДС), тромботические осложнения и др. В новом тысячелетии человечество столкнулось с инфекционными болезнями, о которых никто не знал. COVID-19 С потенциально тяжелая острая респираторная инфекция, вызванная новым тяжелым острым респираторным синдромом [2,3,4]. Клиническая картина, как правило, связана с респираторной инфекцией с тяжестью симптомов, варьирующей от легкой простуды, до тяжелой вирусной пневмонии, приводящей к острому респираторному дистресс-синдрому, который может быть смертельным. Было известно, что, при вспышке новой коронавирусной инфекции, основном обращались с пневмонией. С 17 июля Министерство Здравоохранения Кыргызской Республики включило в статистику по COVID-19 случаи внебольничной пневмонии. Сразу было отмечено что, данные значительно изменились. Увеличились случаи пневмонии с отрицательными результатами анализов на коронавирус. В последующем было принято решение о бесплатном лечении пациентов с пневмоний, как и лечение с диагнозом COVID-19. По республике начали открываться дневные стационары и дополнительные инфекционные отделения в больницах. Для лечения пневмонии в больницах перепрофилируются отделения. Наиболее распространенным клиническим проявлением нового варианта коронавирусной инфекции явилось поражение легких (вирусное диффузное альвеолярное повреждение с микроангиопатией). В настоящее время продолжается интенсивное изучение клинических особенностей заболевания, разработка новых средств его лечения и профилактики [3].

Цель исследования явился сравнительный анализ заболеваемости внебольничной пневмонии для организации оказания качественной медицинской помощи больным пневмонией с коронавирусной инфекцией.

Материалы и методы исследования

В рамках наблюдательного сравнительного исследования проанализированы данные историй болезни больных, которые получали лечение в стационарных условиях Жалал-Абадской области Кыргызской Республики. Было проведено ретроспективное исследование случаев COVID - 19 по данным ЦГСЭН, также в работе представлен анализ клинико - эпидемиологической характеристики случаев COVID - 19, имевших место в г. Жалал - Абад. Диагноз корановирусной инфекций-COVID-19 с пневмонией устанавливали на основании клинико-эпидемиологических, рентгенологических, компютерная томографии и лабораторных данных. Формулировка диагноза проводилась в соответствии с общепринятой клинического протокола Министерство Здравоохранения Кыргызской Республики. Статистическую обработку результатов выполняли на epiinfo 7.1, с использованием пакета программ Excel, что позволило нам получить специальные выходные таблицы и диаграммы. В частности вычисление экстенисвных показателей для изучения общей структуры заболеваний по половозрастной и другим призаком, динамического показателя по отношению к исходному уровню заболеваемости для составления наглядной кривой, определения доли заболеваний по месяцам корановирусной инфекций-COVID-19 с пневмонией. В работе использованы общепринятые методы статистической обработке динамических рядов.

Результаты и их обсуждение

Ретроспективный эпидемиологический анализ показал, что по Жалал-Абадской области за 2020год зарегистрировано 4598 (368,9 на 100тыс. населения) случаев COVID-19 и 5145 (412,8 на 100 тыс.) случаев вне больничной пневмонии. Впервые случаи заболеваемости COVID-19 зарегистрировано в март месяце 2020г, а случаев вне больничной пневмонии пришло, на июнь месяц. Первый случай вне больничной пневмонии было зарегистрировано в июнь месяце в Сузакском районе. Анализы показывают что, Сузакском районе пришлось 15,2 на 100тыс. население (8 случаев), в городе Кара-Куль15,1(4-случаев), последующем в Тогуз-Торунском районе11,2(3 случаев), и Базар-Коргонском районе 0,6(1случаев) на 100тыс. население. По области самая высокая заболеваемость вне больничной пневмоний были зарегистрированы в городе Кара-Куль 845,1 на 100тыс. населения приведены таблица 1. в Чаткальском районе 715,1 и в городе Майлуу-Суу 624,2 и Ноокенском районе 550,6 на 100тыс. население. Остальных районах и городах от 153,9 до 494,8 на 100тыс население. Самая низкая заболеваемости отмечено по области в Токтогульском районе 153,9 и Ала-Букинском районе 193,0 на 100тыс население. Распределение по месяцам в Жалал-Абадской области, самая высокая заболеваемость зарегистрированы вне больничной пневмоний в летний период на июль месяц 149, 9 и осенний период на ноябрь 98.9, на 100тыс население. По городам и районам высокая заболеваемости

зарегистрированы в летний период, на июль месяц Чаткальском районе 380,7, в городе Кара-Куль - 306,9 и в Тогуз –Торунском районе 235,3 на 100тыс население. В осенний период, пик заболеваемости пришлось на ноябрь месяць, в городе Кара-Куль 272,8 и Таш-Комур 262,1, Ноокенском районе 160,6 и Токтогульском районе 148,0 на 100тыс население. В других районах и городах высокая заболеваемость пришлось на октябрь месяц – городе Майлуу-Суу 251,9, Чаткальском районе -106,7. таблица №1. Отдельных территории области не было случаев вне больничной пневмонии в следующих месяцев, осеннего периода, так Тогуз-Торунском районе сентябрь, октябрь и ноябрь, Ноокенском районе и городе Кара-Кул в сентябре месяце. В летний период в Токтогульском районе в августе, в городе Таш-Кумуре в август и декабрь месяцах.

Таблица 1.

Сведения о заболеваемости вне больничной пневмонии, распределение по месяцам городам, районам

Районы и города	Месяцы							Всего	Инт.пок
	VI	VII	VIII	IX	X	XI	XII		
Аксы		175	50	38	126	123	33	545	403,0
		129,4	36,9	28,0	93,1	90,9	24,4		
Ала-Букинск		63	10	5	83	39	6	206	193,0
		59,0	9,3	4,6	77,7	36,5	5,6		
Базар-Курган	1	192	42	7	114	126	56	538	288,9
	0,5	103,1	22,5	3,7	61,2	67,6	30,0		
Ноокен		265	65		192	229	34	785	550,6
		185,8	45,5		134,6	160,6	23,8		
Сузакск	8	617	79	86	209	288	117	1404	464,7
	2,6	204,2	26,1	28,4	69,1	95,3	38,7		
Тогуз-Торунски	3	63	16				4	86	322,6
	11,2	235,3	60,0				15,0		
Токтогул		18		9	61	151	20	259	153,9
		17,6		8,8	59,8	148,0	19,6		
Чаткал		107	56	4	30	4	17	201	715,1
		380,7	199,2	14,2	106,7	14,2	60,4		
г.Жалал-Абад		238	103	1	90	74	17	523	431,6
		196,3	84,9	0,8	74,2	61,0	14,0		
г.Кара-Куль	4	81	25		31	72	10	223	845,1
	15,1	306,9	94,7		117,4	272,8	37,8		
г.Майдуу-Суу		44	25	1	65	14	12	161	624,2
		170,5	96,9	3,8	251,9	54,2	46,5		
г.Таш-Комур		6		16	79	113		214	494,8
		11,5		36,9	182,6	261,2			
Итого по области	16	1869	471	167	1089	1233	309	5145	412,8
Инт пок, на 100тыс. населения.	1,2	149,9	37,7	13,4	87,3	98,9	24,7		

Наибольшее удельный вес заболевщих вне больничной пневмонии по Жалал-Абадской области составило, в возрасте: 30-64 лет 71%, в то же время 65 и выше лет 25%, и 18-29 лет 3,4%, остальных категориях от 0,07%-0,3%. Большой удельный вес заболевших 30-64 лет отмечено в городах Таш-Комур (80,3%), Кара-Куль (78,4%), Майлуу-Суу(75,2%) и г. Жалал-Абад (72,6%), а в районах Базар-Курган, Ноокен (по 71,3%) . Старше 65лет зарегистрировано в районах Аксыйском (28,6%) и Токтогульском(28,1%), в возрасте 18-29лет больше заболели Тогуз-Торунском (10,4%) районе. По Жалал-Абадской области не было случай вне больничной пневмонии в возрасте от 0- 17лет в городах Кара-Куль, Таш-Комур и Ноокенском районе. Детей в возрасте 0-6 лет, не было случай во всех районах и городах, за исключением Сузакского района(2случая). Регистрация летальных случаев от вне больничной пневмоний, по области составило 3,2%. В отдельных районах летальность отмечено выше: В городе Жалал-Абад(6,5%), Тогуз-Торунском районе(5,8%) и Аксыйском(4,4%) районе. В Чаткальском районе не зарегистрированы летальности из число заболевших. По области не было случаев летальности среди детей до 14 лет таблица №2.

Таблица 2

Количество пациентов COVID-19 по возрастам, городам и районам

Районы и города	Возраст/лет					Умерло	Всего
	6-14	15-17	18-29	30-64	65 и вышее		
Аксы	1		17	371	156	24	545
	0,18		3,1	68	28,6	4,4	
Ала-Бука	1	1	10	141	53	6	206
	0,48	0,48	4,8	68,4	25,7	2,9	
Базар-Курган	2	1	14	384	137	7	538
	2,6	1,3	2,6	71,3	25,4	1,3	
Ноокен			30	560	19	11	785
			3,8	71,3	24,8	1,4	
Сузак	7	2	39	979	377	52	1404
	0,49	0,14	2,7	69,7	26,8	3,7	
Тогуз-Торунск		3	9	60	14	5	86
		3,4	10,4	69,7	16,2	5,8	
Токтогул	2	1	16	167	73	9	259
	0,7	0,3	6,1	64,4	28,1	3,4	
Чаткал		2	13	141	45	-	201
		1	6,5	**70,2**	22,3		
г.Жалал-Абад	4		16	380	123	4	523
	0,8		3	72,6	23,6	6,6	
г.Кара-Кул			1	175	47	4	223
			0,4	78,4	21,2	1,8	
г.Майдуу-Суу	1	1	5	121	33	2	161
	0,6	0,6	3,1	75,2	20,5	1,2	
г.Таш-Комур			6	172	36	14	214
			2,8	80,3	16,8	6,5	
Итого по области	20	11	176	3651	1289	168	5145
	0,37	0,2	3,4	71	25	3,2	

Удельный вес заболевших вне больничной пневмоний, по области, составило женщин 52,2% и мужчин -47,8%. Однако удельный вес заболевших вне больничной пневмоний больше мужчин заболели в Ала-Букинском (54,8%), Ноокенском (56,3%) районе и в городе Жалал-Абад (50,1%). В остальных районах и городах области среди женщин вне больничной пневмонии заболели больше таблица 3. По тяжести течение болезни вне больничной пневмонии, по Жалал-Абадской области больше составило средней тяжести - 53,8%, легкое течение -24,7%, тяжелое течение -17,5%, и крайне тяжелое течение-4%. Выше областного показателя распространенности отмечается, средней тяжести в Токтогульском (79,5%), Аксыйском (79,2%), Чаткальском (73,1%), Ноокенском (70,7%), Сузакском (69,9%) районах и городе Майлуу-Суу(74,5%). Выше областного показателя 24,6% удельного веса заболеваемости легкого течения, отмечено в районах Базар-Курган-74%, Ала-Бука-65% и городах Жалал-Абад -85,2%, Кара-Кул 46,6%. Легкое течение вне больничной пневмонии по области, не было зарегистрированы в Аксыйском, Сузакском, Тогуз-Торунском и городе Майлуу-Суу. В этих районах городах основном болели средней тяжести, тяжелой и крайнее тяжелой формой болезни таблица 3. Высокий удельный вес тяжелой формой вне больничной пневмонии по области зарегистрировано в Тогуз-Торунском (73,3%) районе, но в этом районе не было случай крайнее тяжелый формой болезни. По области крайнее тяжелый формой болезни составило 4%. Но высокий удельный вес крайнее тяжелой формы в Ала-Букинском районе составило -9,7% и городе Жалал-Абад 7,6%.

Таблица 3

Заболеваемости вне больничной пневмоний, по полу и степени тяжести

Районов и городов	Всего	Пол		По степени тяжести				
		М	Ж	Легкое	Средней	Тяжелое	Крайне тяжелое	
Аксы	545	270	275		43	9	14	Абс. ч
		49,5	50,5		79,2	18,1	2,5	%
Ала-Бука	206	113	93	135	43	8	20	Абс ч
		54,8	45,1	65,	20,8	3,8	9,7	%
Базар-Курган	538	257	281	398	84	29	27	абс ч
		47,7	52,3	74	15,	5,4	5	%
Ноокен	785	442	343	129	555	86	15	Абс ч
		56,3	43,7	16,4	70,7	11	1,9	%
Сузак	1404	670	734		981	371	52	Абс ч
		47,7	52,3		69,9	26,4	3,7	%
Тогуз-Торо	86	28	58		23	63		Абс ч
		32,5	77,5		26,7	73,3		%
Токтогул	259	123	136	31	206	12	10	Абс ч
		47,5	52,5	12	79,5	4,6	3,9	%
Чаткал	201	84	117	26	147	25	3	Абс ч
		41,8	58,2	13	73,1	12,4	1,5	%
г. Жалал-Абад	523	262	261	445	27	11	40	Абс ч
		50,1	49,9	85,2	5,1	2,1	7,6	%
г. Кара-Кул	223	91	132	104	47	61	11	Абс ч
		40,8	59,2	46,6	21,1%	27,4	4,9	%
г. Майлуу-Суу	161	72	89		120	35	6	Абс ч
		44,7	55,3		74,5	21,7	3,8	%
г. Таш-Кумур	214	100	114	2	101	103	8	Абс ч
		46,7	53,3	0,9	47,1	27,2	3,7	%
Итого по области	5145	2512	2633	1270	2766	903	206	Абс ч
		48,8	52,2	24,7	53,8	17,5	4	%

Из числа заболевших по области 5145 случаев вне больничной пневмоний, умерло 168 человек (3,2%). Таблица 4. Высокий удельный вес умерших от вне больничной пневмоний отмечено в городах Жалал-Абад(6,5%) и Таш-Комур(6,5%) и Тогуз-Торунском районе(5,6%). По области высокий показатель легкой течение(85%)болезни, крайнее тяжелой формы течение(7,6%) и летальности (6,5%) зарегистрированы в городе Жалал-Абаде таблица №4. В Чаткальском районе летальности не было. По области среди детей до 14лет, зарегистрированы вне больничной пневмоний – 16 случаев, среди них умерших не зарегистрированы.

Таблица 4.

Летальность от пневмоний по административным территориям

Наименование городов и районов	Аксы	Ала-Бука	Базар-Коргон	Ноокен	Сузак	Тогуз-Торо	Токтогул	Жалал-Абад	Кара-Кол	Майлуу-Суу	Таш-Комур	Всего
Умерло в абс. ч.	24	6	7	11	52	5	9	34	4	2	14	168
в %	4,06	2,9	1,3	1,3	3,7	5,6	3,4	6,5	1,7	1,2	6,5	3,2

Заключение: Таким образом, начало заболеваемости, вне больничной пневмонии пришло, на июнь месяц, пик заболеваемости зарегистрированы в летний период июль месяц 149,9 и осенний период на ноябрь месяц 98, 9 на 100тыс. население. Наибольшее удельный вес заболевщих вне больничной пневмонии составило, в возрасте: 30-64 лет 71%, и 65 и старше лет 25%, 18-29 лет 3,4%. Летальность от вне больничной пневмоний, по области составило 3,2%, не было случаев летальности среди детей до 14 лет. Заболели вне больничной пневмоний женщин 52,2%, мужчин 47,8%, по течение болезни больше составило средней тяжести 53,8%, легкое течение -24,7%, тяжелое течение 17,5%, крайне тяжелое течение всего лишь 4%.

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PEDAGOGICAL SCIENCES

TƏHSİL KONTEKSTİNDƏ RƏQƏMSALLAŞMA

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DIGITALIZATION IN THE CONTEXT OF EDUCATION

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Annotasiya

Məqalə təhsildə rəqəmsallaşmadan bəhs edir. Texnologiya əsrində, xususilə pandemiya dövründə və sonrasında tədris prosesinin təşkili məsələlərinə toxunulur**.**

Abstract

The article is about digitization in education. In the age of technology, especially during and after the pandemic, the issues of organizing the educational process are addressed.

Açar sözlər: rəqəmsallaşma, təhsil, texnologiya.

Keywords: digitalization, education, technology.

Today, digital competence is important and necessary for everyone in order to be able to actively and continuously participate in society at different levels (economic, social, cultural and educational) and to take advantage of the internet while building resilience to potential risks. The use of digital technologies for social and democratic participation requires the ability to engage positively, critically and competently in the digital environment. Skills are needed to access, select and interpret information, communicate effectively and create content in a way that respects human rights and dignity and uses technology responsibly.

How should we use digital technology in education?

All phases of education have a key role to play in enabling students to continuously acquire and develop the digital competences needed for life, work and learning. There are also concerns about children's socio-emotional, cognitive and physical development due to the potential excessive "screen time". Given that the effects of technology can depend on many factors, including the type of technology used and its purpose, evidence-based guidelines and effective practices are needed to encourage healthy and meaningful use of digital technology from an early age.

Digitalization can simply be explained as the transformation of the skills needed by the world's working population and the young in order to successfully engage in a globalized modern economy. In a learning environment, it is changing the way students learn and also the ways by which institutions deliver education (Webb, McQuaid & Webster, 2021). With the case of covid-19 pandemic, the education system in many countries faced problems as they needed to lead the lectures through digital technologies. But before pandemic digitalization was presented as a universal good but after it became a need and higher education institutions observed a need to provide digital platforms to their students to minimize influence in their learning process. Higher education is one of those industries that should feel the need to assign infrastructure and provide digital technologies for education. Digital transformation alters the experience of the universities and universities need to understand the necessity of developing new situations [Efimov & V. Lapteva, 2018]. Nowadays, especially during and after the pandemic, digital technologies are used for study, work, and for leisure time and it is hard to imagine a life without digital technologies. Similarly, the education system is rapidly changing towards distance learning and cloud computing tools are examples of significant technologies responsible for online lecturing. Before we further dive into digitalization effects on student learning experiences, we must first look into what distance learning is. If we look at the past literature, distance learning can simply be explained as the efforts of providing access to learning for those who are geographically distant [Moore, Dickson Deane & Galyen, 2011]. This means that distance learning occurs when the resources are provided to students who may not be geographically or physically present at a university or institution. In our look for past literature, it was observed that researchers have used inconsistent definitions of distance learning and distance education. Moore, Dickson-Deane & Galyen (2002) in their research point out that as computers became more evolved, they became more involved in the delivery of education, which along with other electronic media were the first enablers of distance learning. Hence, distance learning (DL) can simply be explained as a mechanism in which learning resources and learning materials are made available for individuals which may not be physically or geographically at a university or higher education institution. Lastly, comes hybrid learning which is a result of both, face-to-face learning and distance learning hence the

name, hybrid learning (HL). The disruption in digitalization ultimately leads to changes in the students' mind-sets and along with the learning goals of higher education change. This means that there is a need to adjust and modify learning processes. Digital natives "have little patience for lectures, step-by-step logic, and "tell-test" instruction [Sedelmaier & Landes, 2019].

The first and foremost, benefit of various digitalized communication channels is that contents and knowledge becomes accessible and independent of time or place restrictions [Sedelmaier & Landes, 2019]. With the help of advanced internet search engines, students gain access to knowledge anywhere and at any time. With the help of IOT, cloud computing has been made possible which connects learning managing systems enabling them to share, distribute and retain information on a mass scale. Hence, as compared to previous years, learning processes have become more effective as they are supported by various digitalized technologies Furthermore, education has also become more accessible to more people.

Teachers' positions in higher education have gone through enormous shifts in recent years and still, the question will remain if technology could replace teachers completely. Researchers mentioned that some teachers are very passionate and quick to learn new technologies and are open to developing their digital skills. Some lecturers see technology as a tool for teaching and learning and they are eager to learn the new technologies and add to their competencies [Teräs, Teräs, & Suoranta, 2022].

The negative side of digitalization in distance education is the challenge of managing the process of remote studies and lecturers and students in some cases are not satisfied with distance learning. Sometimes students feel isolated due to the lack of communication, particularly with teachers, because they spend more time at home in front of a computer.

The traditional classes at the universities is one of the factors that teachers and mentors need to consider when they think about digitalization since studying at the university and social environment in education are significant factors in young people's lives.

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ФОРМУВАННЯ ПРОФЕСІЙНОЇ КОМПЕТЕНТНОСТІ ТА ІННОВАЦІЙНОЇ ДІЯЛЬНОСТІ ВИКЛАДАЧІВ ЗАКЛАДУ ВИЩОЇ ОСВІТИ

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FORMATION OF PROFESSIONAL COMPETENCE AND INNOVATIVE ACTIVITY OF TEACHERS OF HIGHER EDUCATION INSTITUTIONS

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Анотація

В статті окреслено значення професійної компетентності вчителів. Зазначено, що вона є першорядним у сучасному контексті, оскільки вони відіграють ключову роль у формуванні суспільства та сприяють розвитку молоді як активного учасника освіти. Крім того, педагогічний потенціал викладачів дозволяє створювати новітні інформаційно-педагогічні ресурси, оптимізуючи тим самим навчальний процес. Зазначено, що досягнення вчителями професійної компетентності вимагає використання компетенцій, які сприяють як навчальним, так і виховним аспектам викладання, а також культивуванню принципів вищої освіти та самореалізації.

Abstract

The article outlines the importance of teachers' professional competence. It is noted that it is paramount in the modern context, as they play a key role in the formation of society and contribute to the development of youth as an active participant in education. In addition, the pedagogical potential of teachers allows creating the latest informational and pedagogical resources, thereby optimizing the educational process. It is noted that the achievement of professional competence by teachers requires the use of competences that contribute to both the educational and educational aspects of teaching, as well as the cultivation of the principles of higher education and self-realization.

Ключові слова: інновації, інноваційні засоби навчання, інноваційна діяльність, компетентність, оцінка компетентності, професійна компетентність, сучасні методики навчання.

Keywords: innovations, innovative means of learning, innovative activity, competence, assessment of competence, professional competence, modern teaching methods.

Значення професійної компетентності вчителів є важливим елементом у сучасному контексті, оскільки вони відіграють важливу роль у формуванні суспільства знань та сприяють розвитку молоді як активного учасника освітнього процесу. Отже, розвиток професійної компетентності є важливим фактором професійної діяльності педагога. Педагогічний потенціал викладачів дозволяє впроваджувати інновації, створювати новітні інформаційно-педагогічні ресурси, оптимізуючи тим самим навчальний процес.

Стаття має за мету дослідити поняття «компетентність» та його актуальність у професійному контексті, з'ясувати складові елементи, що охоплюють професійну компетентність та інноваційну професійну діяльність викладачів закладу вищої освіти.

Відповідно до мети дослідження, визначено такі цілі:

- дати чітке визначення понять «інновації», «інноваційні засоби навчання», «інноваційна діяльність», «компетентність», «оцінка компетентності», «професійна компетентність», «с*учасні методики навчання»*;

- визначити та конкретизувати складові компоненти професійної компетентності вчителя;

- виокремити інноваційні методи навчання;

- охарактеризувати сутність та ознаки інноваційної діяльності викладача.

Однією із загальних тенденцій розвитку вищої освіти в Україні та країнах Європейського освітнього простору є її розвиток на основі модернізації та впровадження інновацій. Саме освітня сфера визначає поступальний рух економіки кожної країни. Сьогодні питання професійної компетентності вчителя середньої освіти є досить актуальним, оскільки у реалізації державної освітньої політики провідна роль належить викладачу, професійна діяльність якого в сучасних умовах значно ускладнюється,

оскільки задаються нові цільові, змістові та методичні орієнтири. Сьогодні вчитель – це не просто людина, яка навчає учнів і передає знання, а людина, яка презентує навчальний заклад, тому вимоги до сучасного педагога змінюються. Крім того, перед вчителем постає завдання вміло використовувати в роботі інноваційні та інтерактивні технології, володіти навичками роботи з комп'ютерною технікою, використовувати інтернет ресурси. Тому виникає потреба у фахівцях з високим рівнем професійної компетентності.

До проблеми професійної компетентності викладачів звертаються багато вчених. Різні аспекти цієї проблеми стали предметом наукових досліджень І. І. Бондаренко, М. Васильєвої, О. Вознюк, Л. Голованчук, І., М. Головань, І. Дроздової, О. Дубасенюк, А. Журавльова, С. Козак, М. Левківського, В. Т. Лозовецька , А. Маркової, Г. Мельниченко, Г. Мухамедзянової, О. Палій, Л. Петровської, О. Пометун, Л. Пуховської, О.Я.Савченко, Н. Саєнко, В.І. Саюк, С.О. Сисоєва, В.А. Семиченко.

Аналіз літературних джерел, предметом якого є впровадження інноваційних технологій в освітнє середовище сучасного навчального закладу з урахуванням позитивного європейського досвіду в сучасній Україні, свідчить про значний інтерес науковців до цих питань.

Зазвичай, термін «інновації» використовується для позначення процесу створення, впровадження та поширення нововведень в організаціях та суспільстві в цілому з метою досягнення розвитку і покращення [9].

Досліджуючи механізми державного регулювання системи сучасної вищої освіти, О.Є. Кузьмін, М. Яструбський [3] зазначають, що в сучасній вищій освіті домінує роль держави в регулюванні освітньої діяльності закладів вищої освіти.

На основі аналізу зарубіжних джерел щодо визначення понять «компетенція» та «компетентність» С.О. Сисоєва [7, с.11] робить висновок про те, що означення даних понять мають різнопланову багатокомпонентну структуру та полісемантичне значення. Компетенція, на думку вченої, – це визначена норма стосовно неперервної освіти, яка задається освітніми стандартами і використовується для формування вимог до результатів навчання. Компетентність – це інтегрована особистісна якість людини (її капітал), що формується на етапі навчання, остаточно оформлюється і розвивається у процесі практичної діяльності та забезпечує компетентний підхід до вирішення професійних завдань. Компетентність є оцінною характеристикою особи. Компетентності особи є її особистісним капіталом і результатом навчання у різних формах формальної, неформальної та інформальної освіти. Компетентністний підхід – це підхід, спрямований на формування компетентності особи.

Наукове дослідження М. Головань [1, с.82] зосереджено на дослідженні компонентів, які становлять професійну компетентність викладача університету. У статті «Професійна компетентність викладача вищого навчального закладу» вона вказує на важливість наявності у викладача як педагогічних, так і дослідницьких здібностей, а також певних особистісних якостей та соціально-психологічних рис особистості. Для наукової діяльності важливими є також особистісні якості: допитливість (головний стимул для засвоєння необхідних спеціальних знань і важливий стимул для власної дослідницької роботи); постійний інтерес до наукових успіхів в інших галузях знань; наукова витривалість у роботі зі своєю науковою проблемою і наукова вимогливість до себе); дисциплінованість, прагнення до точності результатів; ентузіазм і старанність у роботі; критичність і самокритичність; уміння співпрацювати з людьми [1, с.82].

О. А. Дубасенюк [2] зазначає, що інновації в педагогіці пов'язані із загальними процесами в суспільстві, глобалізаційними та інтеграційними процесами. Як системне утворення інновація характеризується інтегральними якостями: інноваційний процес, інноваційна діяльність, інноваційний потенціал, інноваційне середовище.

Саюк В.І. [5] у своєму дослідженні «Професійна компетентність - основа розвитку сучасного викладача системи післядипломної педагогічної освіти» виділяє такі її компоненти:

а) мотиваційний - сукупність потреб, мотивів, інтересів, ціннісних орієнтацій, ставлень, адекватних цілям і завданням педагогічної діяльності, та їх інтегративних комплексів (пізнавальні потреби й інтереси, гуманістична спрямованість, прагнення реалізуватись у науково-педагогічній діяльності тощо);

б) когнітивний - сукупність знань, необхідних для здійснення науково-педагогічної діяльності (знання предмета, педагогічні, психологічні, основи організації й управління навчальним процесом тощо);

в) операційний - сукупність умінь і навичок, необхідних для практичного вирішення навчальних і виховних задач (уміння встановлювати міжособистісний контакт, організовувати міжособистісну взаємодію, упорядковувати і передавати навчальну інформацію тощо);

г) особистісний - сукупність важливих для професійної педагогічної діяльності особистісних якостей (комунікативність, відповідальність, емпатійність, готовність до рефлексії, здатність до самоаналізу і самоуправління тощо).

Дослідниця також окремо виділяє такі види компетентностей викладача: психологічна, предметна, дидактична, методична, комунікативна, управлінська, проективна тощо і приходить до висновку щодо пріоритетності проблеми розробки діагностичного інструментарію для визначення рівня професійної компетентності викладачів та виокремленні організаційно-педагогічних умов їх розвитку.

Значний вклад у розуміння та розвиток інновацій в освіті внесли американські та британські дослідники. Їх роботи часто є джерелом інсайтів та рекомендацій для вчителів та освітніх діячів у США, Великій Британії та інших країнах. Ними є: американські дослідники: **Dr. Richard Mayer [10]** (відомий когнітивний психолог, який зосереджується на

дослідженнях з використанням мультимедіа та технологій в навчанні), **Dr. John Hattie [9]** (австралійський вчений, але його роботи і дослідження про вплив різних методів навчання мають широкий резонанс у США. Він досліджує ефективність різних педагогічних підходів та інновацій), Доктор Джон Гетті (John Hattie) є видатним австралійським вченим у галузі освіти. Його роботи та дослідження щодо впливу різних методів навчання отримали всесвітнє визнання, включаючи і в Сполучених Штатах. Він відомий своєю роботою з синтезування наукових даних та мета-дослідженнями, які допомагають визначити, які педагогічні підходи є найбільш ефективними для досягнення навчальних цілей. Один із найважливіших результатів його досліджень - це «Синтез видимого навчання» (Visible Learning), в якому він аналізує величезний обсяг даних про вплив різних чинників на навчальний процес. Цей синтез включає багато важливих аспектів освіти, таких як здібності вчителя, зворотний зв'язок, вплив сім'ї, класні розміри, педагогічні методи та багато інших. Результати цих досліджень допомагають вчителям, школам і політикам приймати більш обгрунтовані рішення щодо поліпшення якості навчання і досягнення кращих результатів учнів. Доктор Гетті активно співпрацює з освітянами та вчителями в США і інших країнах, надаючи консультації та підтримку для впровадження його досліджень у практиці. Його роботи і ідеї мають значний вплив на освітню практику та політику в багатьох країнах світу, включаючи Сполучені Штати Америки.

Оцінка компетентності - це оцінка здібностей викладача відповідно до вимог професійної діяльності. Ці вимоги визначені в моделі компетенцій. Щоб бути цінними, моделі компетенцій повинні включати лише ті завдання та навички, які мають вирішальне значення для успішної роботи, а не всі види діяльності, які викладачі виконують (як того передбачає традиційний аналіз робочих завдань).

До іноваційної діяльності викладача входять такі її різновиди:

Сучасні методики навчання: Інноваційні підходи до викладання, як то: змішане навчання (blended learning), зворотний клас (flipped classroom), проектне навчання та інші, спрямовані на покращення засвоєння матеріалу і розвиток критичного мислення учнів.

Інтерактивні технічні засоби навчання: комп'ютери, планшети, інтерактивні дошки, спеціальне програмне забезпечення та інші електронні ресурси.

Мультимедійні матеріали. Відео, аудіо, малюнки, ілюстрацій і графіки для наочного пояснення матеріалу та оптимального подання інформації.

Відкриті онлайн-ресурси. Інтернет надає доступ до навчальних матеріалів, а саме: відеоуроки, веб-сайти, інтерактивні курси, які можна використовувати для самостійної роботи.

Віртуальна реальність (VR) та доповнена реальність (AR): Використання VR- та AR- технологій, які дозволяють створювати навчальні середовища, де учні можуть вивчати різні предмети у віртуальному або розширеному просторі.

Аналітика даних і штучний інтелект. Можливість використання аналітичних інструментів і штучного інтелекту для збору та аналізу даних про навчальний процес та індивідуальний успіх учнів.

Глобальне навчання: Використання засобів для здійснення спільного навчання з учнями та вчителями з інших країн, щоб розширити світогляд та культурний досвід.

Використання інноваційних засобів навчання може покращити доступ до якісної освіти та зробити навчання більш цікавим і ефективним через:

- **симуляційні ігри та тренінги** (використання сучасних інтерактивних ігор та тренінгів для вдосконалення навичок міжособистої комунікації, ведення переговорів, роботи в команді тощо. Це допомагає студентам навчитися ефективно спілкуватися в різних професійних ситуаціях);

- **використання відео та аудіо матеріалів** (створення та аналіз відео- або аудіозаписів інтерв'ю, презентацій або інших комунікаційних ситуацій, щоб студенти могли оцінювати та покращувати свої навички);

- **використання соціальних мереж та віртуальних спільнот** (створення віртуальних професійних спільнот або обговорення професійних тем в соціальних мережах, що сприяє вдосконаленню навичок письмової комунікації та взаємодії з колегами);

- **використання онлайн-платформ для навчання** (використання спеціалізованих онлайн-платформ, які пропонують курси з міжособистої комунікації, ведення ділової переписки, публічних виступів тощо);

- **рольові ігри та імпровізація** (використання рольових ігор та імпровізації на заняттях для покращення навичок вербальної та невербальної комунікації);

- **спеціалізовані курси з міжкультурної комунікації** (створення курсів, спрямованих на розуміння та покращення міжкультурної комунікації, яка є важливою для гуманітарних спеціальностей);

- **використання онлайн-сервісів для покращення письмових навичок** (використання сервісів для перевірки правопису та граматики, а також інструментів для написання та редагування текстів);

- **використання штучного інтелекту та аналітики даних** (використання інструментів на основі штучного інтелекту для аналізу ефективності комунікаційних навичок студентів і рекомендацій щодо покращення).

Ці інноваційні засоби можуть допомогти студентам гуманітарних спеціальностей розвивати важливі навички професійної комунікації та готуватися до майбутньої кар'єри в своїй обраній галузі.

Формування культури професійної комунікації студентів гуманітарних спеціальностей у вищих навчальних закладах (ЗВО) може включати в себе різноманітні інноваційні засоби та методи. Ось деякі ідеї щодо таких засобів.

Проведений аналіз свідчить, що зусиллями науковців і практиків за час реалізації положень Болонського процесу в Україні створене підгрунття для впровадження компетентнісного підходу та розробки навчальних програм на засадах компетенцій. Такі програми, зокрема, були розроблені та реалізуються у Миколаївському національному університеті ім. В.О.Сухомлинського. Враховуючи важливість інформаційних і комунікаційних технологій, компетенції вчителів тісно пов'язані з новими вимогами до навчальних програмам, які передбачають використання інформаційного простору. Заслуговує на увагу вплив сучасних інформаційних технологій на інноваційну діяльність викладачів.

Аналіз науково-методичної літератури дає підстави зробити висновки про те, що структура професійної компетентності демонструє різноманітність і охоплює різні компоненти, серед яких рефлексія та психолого-педагогічні аспекти є центральними. Крім того, інноваційність педагогічних практик тісно пов'язана з уявою та креативністю.

Інновація в освіті - це процес створення, впровадження та поширення нових ідей, педагогічних та управлінських засобів у технологіях освітньої практики, у результаті якого підвищуються показники (рівні) досягнень структурних компонентів освіти, відбувається перехід систему в якісно інший стан.

Інноваційні засоби навчання - це технологічні або методичні засоби та ресурси, які використовуються для поліпшення процесу навчання та збільшення ефективності освіти. Ці засоби можуть включати в себе різноманітні технології, програми, пристрої, методики та підходи до навчання, які сприяють активному залученню учнів, підвищенню їхнього інтересу до навчання та покращенню результатів.

Різні компоненти - це оцінка здібностей вчителя відповідно до вимог професійної діяльності. Ці вимоги визначені в моделі компетенцій. Моделі компетенцій повинні включати лише ті завдання та навички, які мають вирішальне значення для успішної професійної діяльності. Оцінювання має проводиться відповідно до конкретних завдань і навичок.

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SOCIAL SCIENCES

ANALYZE THE IMPACT OF CHINA'S BELT AND ROAD INITIATIVE ON THE EUROPEAN ECONOMY

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DOI: 10.5281/zenodo.10132771

Abstract

The Belt and Road Initiative, a major international cooperation initiative put forward by China in 2013, aims to build an economic cooperation platform connecting Asia, Europe and Africa along the two main routes of the ancient Silk Road. These two routes are the "Silk Road Economic Belt" and the "21st Century Maritime Silk Road".

The goal of the Belt and Road Initiative is to promote policy communication, facility connectivity, trade facilitation, financial integration and people to people connectivity among countries along the Belt and Road, build a global connectivity partnership, and promote regional economic integration and global sustainable development through the principle of joint consultation, joint construction and sharing.

The main contents of the Belt and Road Initiative include the following aspects:

1. Build key projects such as cross-border economic cooperation zones and industrial parks to promote industrial investment cooperation.

2. Promote trade liberalization and facilitation, sign multilateral or bilateral agreements such as free trade agreements and investment agreements, and innovate trade methods.

3. Build a multi-level financing platform, set up financial institutions such as the the Silk Road Fund and the Asian Infrastructure Investment Bank, and expand two-way investment scale.

4. Strengthen cultural exchanges and cooperation, carry out exchange projects in fields such as education, technology, culture, and tourism, and enhance people-to-people communication.

Keywords: Belt and Road, Development, Europe

1. Promotion of trade and investment between china and europe through initiatives

1.1 Promotion of Trade and Investment between China and Europe through the Initiative

By 2023, the "the Belt and Road" initiative will involve 151 countries and 32 international organizations, benefiting 60% of the world's population, accounting for 30% of global GDP and 75% of global energy reserves. Moreover, China's trade in goods with countries along the "the Belt and Road" has set a new record in 2022, reaching 13.8 trillion yuan. Since the launch of the initiative, China's "the Belt and Road" projects have totaled US $962 billion, including US $573 billion in construction contracts and US $389 billion in non-financial investment. Overall, China has initiated approximately 200 transactions, involving over 3000 projects, established over 80 overseas economic and trade cooperation zones, and created over 420000 job opportunities for local people.

The "the Belt and Road" initiative is an open platform proposed by China to promote cooperation in Asia, Europe and Africa. It aims to achieve mutual benefit, win-win results and common development by strengthening five cooperation areas, including policy communication, facility connectivity, unimpeded trade, financial integration and people to people connectivity. Provided impetus and opportunities for European economic growth, employment, competitiveness, and innovation [1].

China EU trade and investment are important contents and achievements of the "the Belt and Road" initiative. According to data from the Ministry of Commerce of China, in 2020, the bilateral trade volume between China and Europe reached 650.53 billion US dollars, a year-on-year increase of 5.3%, accounting for 16.4% of China's total foreign trade. At the end of 2020, China and Europe reached negotiations on a comprehensive investment agreement, creating new opportunities for both sides to deepen economic cooperation [2].

On the one hand, the Belt and Road Initiative has brought influence and contribution to European economic restructuring, sustainable development and social welfare by strengthening China EU cooperation in infrastructure, energy, green development, digital transformation, public health and other fields.

On the other hand, the Belt and Road Initiative has created conditions and platforms for the European economy to participate in the reform of the global governance system and build an open world economy by deepening the coordination and dialogue between China and Europe in policy communication, rule making, security and other aspects.

1.2. The Benefits of China Europe Express on China Europe Trade Economy and Investment

China Railway Express (hereinafter referred to as CR express) refers to the container international railway intermodal train running between China and Europe as well as countries along the Belt and Road in accordance with the fixed train number, route, schedule and full journey operation time.

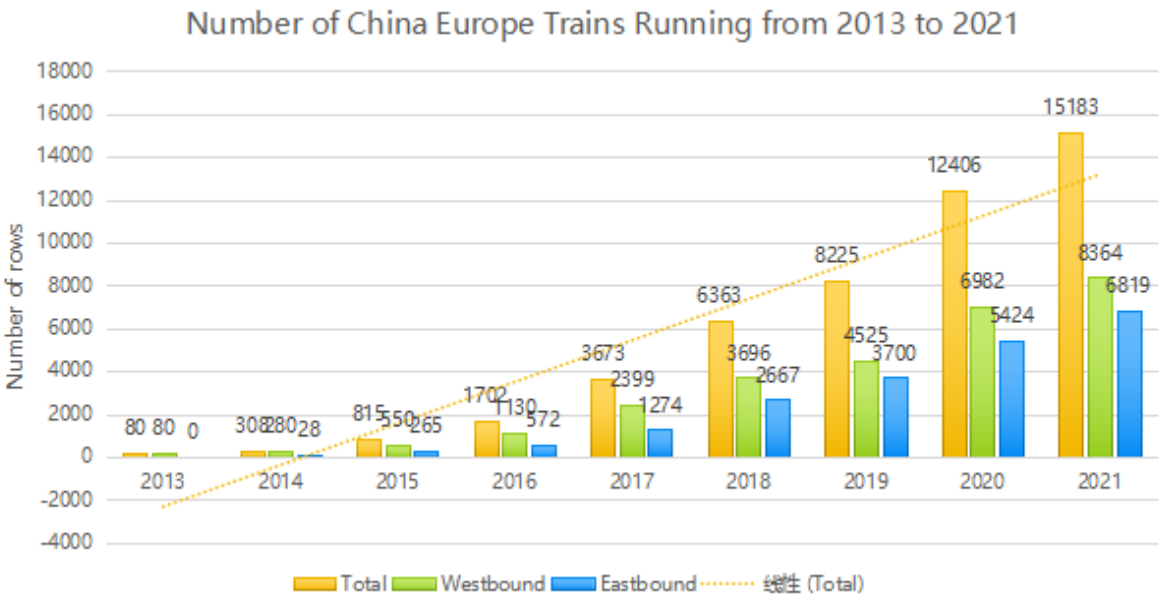
China Europe Express has laid out three routes in the West and Middle East: the western route passes through Alataw Pass (Khorgos) in central and western China, the central route passes through Erenhot in northern China, and the eastern route passes through Manzhouli (Suifen River) in coastal areas in southeast China. In March 2011, the first China Europe train departed from Chongqing to Duisburg, Germany, marking the beginning of the innovative development of China Europe trains. The opening of the China Europe train has strengthened commercial and trade ties with European countries, becoming the backbone of international logistics and land transportation.

In 2021, the 10th anniversary of the operation of the China Europe Express. In the past 10 years, China Europe Express has exceeded 40000 trains, with a total value of over 200 billion US dollars. It has opened 73 operating routes and reached over 160 cities in 22 European countries. In the past 10 years, the China Europe Express has opened a new chapter in land transportation between Asia and Europe, forging a bridge and link for mutual benefit and win-win cooperation among countries along the route.

On December 18, 2022, the first China Europe train (Qilu) from the Shanghai Cooperation Demonstration Zone to Kopel, Slovenia will start.

China Europe Express is an international logistics brand under the "the Belt and Road" initiative and an important transportation link between China and Europe. The China Europe Express has advantages such as convenience, speed, security, stability, and a green economy, providing new logistics options for international trade between Asia and Europe, in addition to sea and air transportation. It promotes trade and investment facilitation for countries along the route, and builds a more open, inclusive, and inclusive "Express Economy"[3].

The China Europe train has reduced logistics costs and time. Compared to sea freight, the transportation time of the China Europe freight train has been shortened by more than two-thirds, and the freight cost has been saved by more than 80% compared to air freight. This makes the transportation of goods between China and Europe more efficient, economical, and reliable, improving the market competitiveness and confidence of both sides [4].



Data source: "China Europe Train Development Report (2021)"

The China Europe Express has expanded its trade varieties and markets. The China Europe freight train transports over 50000 types of goods, covering various fields such as mechanical and electrical products, automotive parts, clothing, shoes and hats, daily necessities, and food. The China Europe Railway also provides more business opportunities and choices for countries along the route, promoting the circulation of goods and consumer demand in the region.

The China Europe train has promoted the upgrading of the industrial chain and value chain. The China Europe Express is not only a logistics channel, but also an industrial chain and value chain. The countries along the route have achieved industrial complementarity and coordinated development through the China Europe train, improving their own industrial level and added value. For example, China and Germany have conducted deep cooperation in the field of automobile manufacturing, China and Poland have exchanged advantages in the field of agricultural product processing, and China and Belarus have conducted innovative cooperation in the field of dairy products.

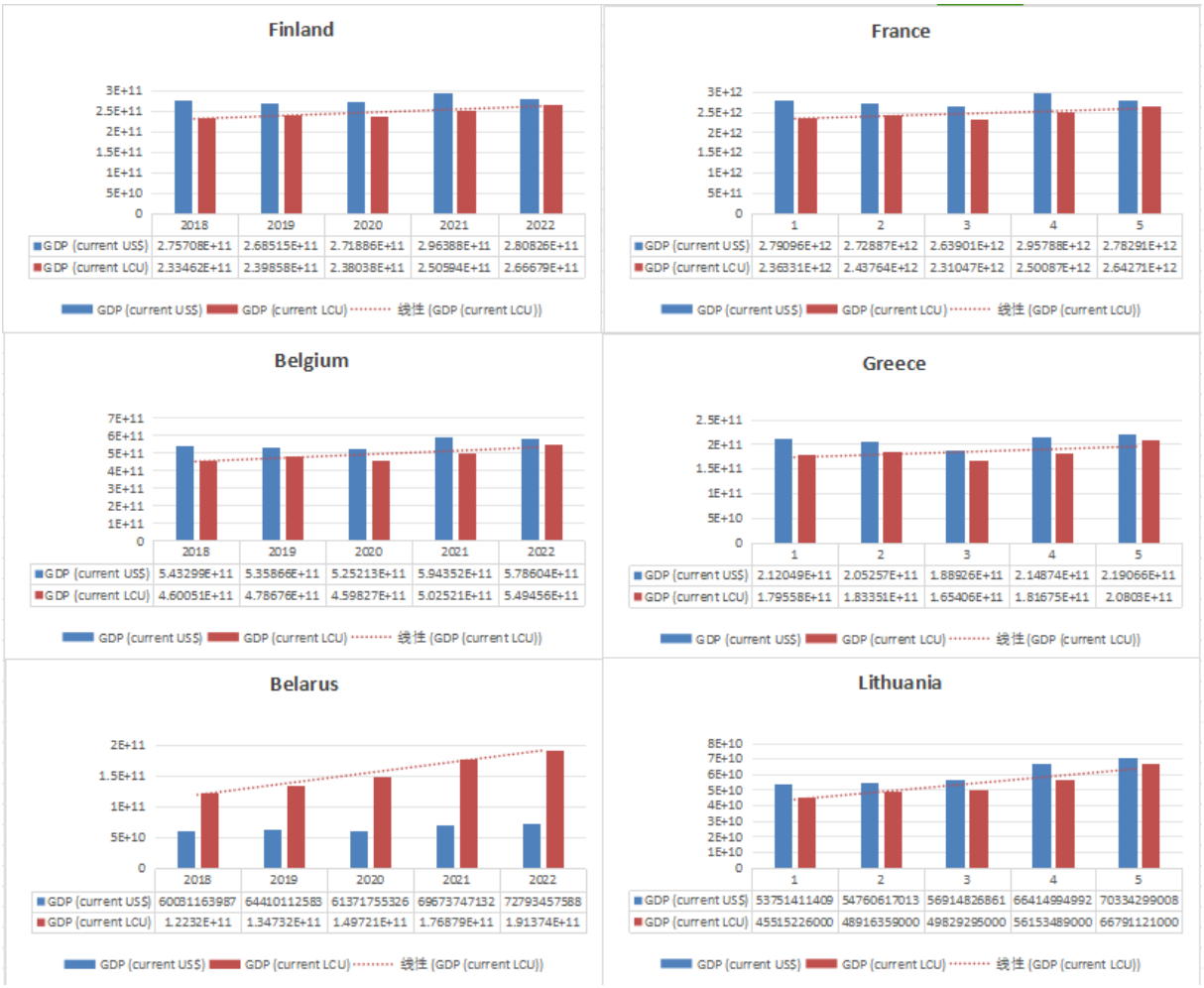
1.3. The Contribution of China Europe Express to European Economic Growth

The China Europe Express has become the backbone mode of land transportation in international logistics due to its characteristics of short distance, fast speed, high safety, as well as its advantages of safety, speed, environmental protection, and minimal impact from the natural environment. At present, more than 70 operating lines have been opened, connecting more than 170 cities in over 20 European countries, increasing the vitality and potential of the European economy. The increasingly mature logistics organization of China EU scheduled trains, the increasingly active economic and trade exchanges of countries along the routes, and the increasingly close cooperation between railway, port, customs and other departments among countries have all these favorable conditions, which play an important role for the railway to further play its role as the backbone of international logistics, and in the "the Belt and Road" strategy to transform the Silk Road from the original "trade road" to the "economic belt" with industry and population concentration.

The China Europe Express has provided more market opportunities and development space for European enterprises, injecting new impetus into European economic growth. According to data from the European Bureau of Statistics, in 2020, China surpassed the United States to become the EU's largest trading partner, with bilateral trade reaching 586.2 billion euros, a year-on-year increase of 5.3%.

The China Europe train has created employment and income in Europe. The China Europe Express has provided a large number of employment opportunities and income sources for European logistics, industry, commerce, and other fields, contributing to social stability and improving people's livelihoods in Europe. According to a research report by Roland Berger, a German consulting firm, the China Europe train creates approximately 11000 jobs in Germany every year, bringing about 1 billion euros in economic benefits.

The China Europe train has enhanced European competitiveness and innovation capabilities. The China Europe Express provides faster, more flexible, and more reliable logistics services for European companies, enhancing their competitive advantage in the international market. At the same time, the China Europe train has also promoted cooperation among countries along the route in areas such as green development, digital transformation, and public health, stimulating the innovation vitality and potential of both sides.



Randomly selecting six European countries, we can clearly see that GDP is showing a growth trend, and the data is sourced from the World Bank.

2. The belt and road initiative promotes china eu cooperation in various fields

2.1. In terms of green development

Green is the background of jointly building the "the Belt and Road". Green development is the direction of world development and the responsibility and mission of all countries in the world. In 2020, China announced to the world its goal of reaching carbon peak by 2030 and achieving carbon neutrality by 2060. In 2021, China released the "Action Plan for Carbon Peak before 2030". In 2019, The European Union announced the "European Green Association". Both China and Europe attach great importance to the construction of ecological civilization and the response to climate change, and regard green as the joint construction of the "the Belt and Road" The important principles and objectives of. The two sides have conducted extensive cooperation in areas such as clean energy, green infrastructure, environmental protection, and circular economy, making contributions to promoting global green and low-carbon transformation. For example, China and Europe have carried out multiple cooperation projects in the fields of renewable energy such as wind power and solar energy, such as the Pakistan Juba wind farm jointly constructed by China and Germany, and the Egypt Benban wind farm jointly constructed by China and France

Juba Wind Farm is one of the key energy projects under the framework of the China Pakistan Economic Corridor, and also the first cooperation project between China and Germany under the "the Belt and Road" initiative [6].

The project is jointly invested and constructed by China Power Construction International Corporation and Siemens Corporation in Germany, with a total installed capacity of 100 megawatts, consisting of 33 wind turbines with a single unit capacity of 3 megawatts [7].

The project is located in the southern province of Sindh, Pakistan, approximately 120 kilometers away from Karachi City. It has abundant wind energy resources and an average annual wind speed of 7.5 meters per second [8].

The project started construction in October 2017 and was officially connected to the grid for power generation in August 2019. It can transmit approximately 3 billion kilowatt hours of clean electricity annually to the Pakistan National Grid, meeting the electricity needs of approximately 1 million households and reducing approximately 900000 tons of carbon dioxide emissions [9].

This project is a successful example of cooperation between China and Germany in the field of new energy, providing useful experience and demonstration effects for promoting the construction of the China Pakistan Economic Corridor and China Germany energy cooperation.

2.2. In terms of digital transformation

In terms of digital transformation, both China and Europe are committed to promoting the development of the digital economy and digital governance innovation, and regard digitalization as an important content and means of jointly building the "the Belt and Road". The two sides have conducted in-depth cooperation in areas such as digital infrastructure, digital trade, and the Digital Silk Road, providing support for improving connectivity and service capabilities. For example, China and Europe have carried out multiple cooperation projects in cutting-edge technologies such as 5G, the Internet of Things, and artificial intelligence, such as the Rome 5G Smart City Demonstration Zone jointly constructed by China and Italy, and the Morocco 5G Smart Port jointly constructed by China and France [10].

The Rome 5G Smart City Demonstration Zone, jointly constructed by China and Italy, is a project aimed at utilizing 5G technology to improve urban management and service levels. The project was jointly promoted by Huawei China and TIM, an Italian telecommunications operator, and was officially launched in September 2022. It is planned to be completed by 2024 [11].

The goal of this project is to build 5G infrastructure and applications in some important areas of the city center of Rome, such as Vittorino Square, Venice Square, Spanish Square, and St. Peter's Basilica, including intelligent transportation, intelligent security, intelligent tourism, intelligent healthcare, etc [12, 13]. It can not only improve the quality of life of Roman citizens and the attractiveness of the city, but also strengthen cooperation and exchanges between China and Italy in the digital field, promoting economic development and innovation capabilities of both sides. [14, 15]

The first high-level dialogue in the digital field was held between China and the EU in September 2020, during which discussions were held on topics such as the digital economy, artificial intelligence, cybersecurity, and digital taxation. It was agreed to build a digital partnership between China and the EU. In 2015, a joint statement on 5G strategic cooperation was signed, establishing a dialogue mechanism on information technology, telecommunications, and informatization between China and Europe, and strengthening cooperation in 5G international standard formulation, technology research and development, and testing. Data flow.

In December 2020, the China Europe Comprehensive Investment Agreement was reached, which includes relevant rules for cross-border data flow and provides legal protection for cooperation between the two sides in the field of data.

In March 2021, a new round of China Europe joint research funding agreement and the fifth phase cooperation agreement of the China Europe Science and Technology Cooperation "Dragon Plan" were signed. In the future, both sides will accelerate the implementation of research and development projects, the establishment of cooperation mechanisms, and the exchange of scientific and technological talents in fields such as agriculture, food and biotechnology, as well as climate change and biodiversity.

2.3. In terms of public health

Both China and Europe insist on taking people's health as the center, and regard public health as an important field and priority task of jointly building the "the Belt and Road". The two sides have conducted close cooperation in areas such as epidemic prevention and control, vaccine supply, and medical assistance, playing a positive role in maintaining global public health safety and human health and well-being. For example, China and Europe support and cooperate with each other in the fight against the COVID-19, jointly donate and purchase medical materials, jointly carry out scientific research and drug research and development, and jointly participate in global health governance and multilateral mechanisms.

3. Challenges and risks faced by the "the belt and road" initiative

3.1. Attitudes of different European countries towards China's the Belt and Road Initiative

European countries have different attitudes towards China's the Belt and Road Initiative. Some support or welcome it, some doubt or oppose it, and some are neutral or wait-and-see. These attitudes are influenced by factors such as the history, geography, politics, and economy of various countries, as well as the positions and pressures of Western countries such as the United States.

Support or welcome: Greece, Italy, Hungary and other countries are the first countries in Europe to participate in the Belt and Road cooperation. They believe that the initiative can bring them opportunities and interests in investment, trade, infrastructure and other aspects, as well as enhance their voice and influence within and outside the EU.

Suspicion or opposition: France, Germany, the United Kingdom and other countries are the largest economic and political forces in Europe. They are cautious or critical of the Belt and Road Initiative, fearing that the initiative will weaken the unity and cohesion of the EU, threaten European values and rule systems, and damage Europe's position and interests in global affairs. They were also influenced and urged by the United States and other western countries to require China to abide by the principles of transparency, fairness and sustainability in the Belt and Road cooperation.

Neutral or wait-and-see: Poland, the Czech Republic, Ukraine and other countries are important countries in central and eastern Europe. They are open or hesitant to the Belt and Road Initiative. They not only see the potential of the initiative in promoting regional development and connecting Asia and Europe, but also face pressure and restrictions from the European Union and the United States. They hope to maintain their own interests and sovereignty when participating in the Belt and Road cooperation, and balance their relations with China, Russia, the EU, the United States and other parties.

3.2. The positive and negative impacts of the Belt and Road Initiative on European economic development

Positive impact:

Promoted the growth of trade and investment between China and Europe. From 2013 to 2021, the total trade volume of goods between China and European countries along the Belt and Road has reached 4.2 trillion dollars, accounting for 36.2% of the total trade volume between China and countries along the Belt and Road in the same period; China's direct investment in European countries along the Belt and Road has reached 56 billion US dollars, accounting for 34.7% of China's total investment in countries along the Belt and Road in the same period.

We have improved the level of infrastructure connectivity between China and Europe. As an important part of the "the Belt and Road" initiative, China Europe Express has become an international transportation artery connecting China and Europe logistics. As of the end of January 2022, the cumulative number of China Europe freight trains has exceeded 50000, transporting over 4.55 million TEUs of goods with a value of $240 billion, and reaching 200 cities in 24 European countries. In addition, China has also participated in the construction and operation of major projects such as the Greek port of Piraeus and the Hungarian Serbian railway.

It has enhanced political mutual trust and cultural exchange between China and Europe. China and the EU signed the 2025 Strategic Plan for China EU Comprehensive Strategic Partnership, and carried out multi field, multi-level and multi form cooperation dialogues under the framework of the "the Belt and Road". China has also signed "Certified Operators (AEOs)" mutual recognition agreements with 31 economies such as ASEAN and the European Union, simplifying customs procedures and inspection and quarantine requirements.

In addition, China has also carried out cultural exchanges with European countries along the route in areas such as education, technology, culture, tourism, etc., which has enhanced people-to-people communication.

Negative impact:

This has sparked concerns and resistance from some European countries and institutions regarding China's expansion of influence. Some European countries and institutions believe that the "the Belt and Road" initiative is a tool for China to promote its own values and interests in the world, which may weaken Europe's position and voice in global affairs, and even lead to internal division in Europe. Therefore, they have conducted strict scrutiny and restrictions on China's investments and projects in Europe, and even implemented sanctions and boycott measures.

Increased economic and trade friction and competitive pressure between China and Europe. With the promotion of the "the Belt and Road" initiative, China's competitiveness in the European market has continued to improve, but also faces more challenges and obstacles from European enterprises and governments. Some European countries and institutions accuse China of lacking transparency and fairness in its investments and projects in Europe, suspected of dumping and subsidies, and damaging the interests of European enterprises and market order. In addition, there are also differences and controversies between China and Europe in terms of intellectual property protection, environmental standards, and labor rights.

In short, the "the Belt and Road" initiative has both advantages and disadvantages for European economic development. It requires China and the EU to strengthen communication and coordination, expand cooperation areas and space, properly handle differences and frictions, and achieve mutual benefit and win-win results.

3.3 Risks and Suggestions of the "the Belt and Road" Initiative in Europe

In 2013, China put forward the "the Belt and Road" initiative to promote policy communication, facilities connectivity, smooth trade, financial integration, and people to people connectivity among countries along the Belt and Road to achieve common development and prosperity. Europe is an important partner of the "the Belt and Road" and a beneficiary of the "the Belt and Road" construction. [16] In which areas does China need European technical support? China also needs European technical support in certain areas, such as chemical engineering. Europe has advanced technology and products in the field of chemical engineering, such as Kostron from Germany and Liquid Air from France. China still has a high demand for imported chemical raw materials, high-end chemical products, and chemical equipment, and needs to improve its independent innovation capabilities and international competitiveness. Software and simulation technology. Europe has rich experience and achievements in software and simulation technology, such as Dassault in France and SAP in Germany. China still has significant development space and potential for improvement in fields such as industrial software, simulation, and artificial intelligence, and needs to strengthen cooperation, exchange, and technology introduction with Europe.

Aviation equipment. Europe has leading technologies and brands in the field of aviation equipment, such as Airbus, UK RR, France Safran, etc. China still faces technological bottlenecks in aviation engines, aviation materials, and avionics, and needs to accelerate independent research and development to break through the "bottleneck" problem.

Industrial equipment. Europe has advantages and innovation in the field of industrial equipment, such as Achemir in Switzerland and ABB in Sweden. China still heavily relies on imports in fields such as CNC machine tools, high-end sensors, and intelligent manufacturing, and needs to improve its level of independent design and manufacturing.

In Europe, the joint construction of the "the Belt and Road" faces a complex situation of opportunities and risks. On the one hand, European countries hold an open and inclusive attitude towards the "the Belt and Road" initiative, believing that it is a platform conducive to promoting connectivity, mutual trust and cooperation, and promoting multilateralism [17].

European countries and China have extensive cooperation space and potential in areas such as infrastructure construction, energy resource development, and digital economy innovation [18]. The two sides can also strengthen coordination and cooperation on global issues such as tackling climate change and maintaining global public health security through the "the Belt and Road" initiative [19].

On the other hand, European countries also have some doubts and concerns about the "the Belt and Road" initiative, mainly involving transparency, standards, rules, debt sustainability and other aspects. European countries are also worried that the "the Belt and Road" initiative will affect European unity and stability and weaken the EU's influence and voice in international affairs. In addition, the United States has a negative attitude towards the "the Belt and Road" initiative, trying to obstruct and suppress China EU cooperation, bringing external pressure and interference to the cooperation between the two countries.

The Belt and Road also faces some risks and challenges in Europe, mainly including the following aspects:

1. Political risks. There are different political views and interest demands within Europe, and different attitudes and participation levels towards the "the Belt and Road" initiative. Some countries and regions are suspicious or hostile to China's influence and intentions, and believe that the "the Belt and Road" initiative is China's geopolitical strategy, which may undermine European unity and security. In addition, Europe is also under pressure and influence from the United States and other countries or regions, which may have a negative impact on the "the Belt and Road" initiative.

2. Economic risks. Europe has a relatively high level of economic development, intense market competition, and relatively complete and strict laws and regulations. This puts forward higher requirements and standards for project investment and operation under the "the Belt and Road" initiative. At the same time, due to the impact of the COVID-19, the European economy has been severely impacted, leading to the deterioration of some countries' fiscal deficits, debt levels, unemployment rates and other indicators, increasing the financing difficulty and default risk of projects under the "the Belt and Road" initiative.

3. Social risks. European society has a high degree of diversity, with differences in culture, religion, values, and other aspects. This may lead to communication barriers, lack of trust, misunderstanding and other problems, affecting the smooth implementation and social benefits of the project under the "the Belt and Road" initiative. In addition, there are also anti globalization, populism, protectionism and other thoughts and emotions in European society, which may resist or oppose the "the Belt and Road" initiative.

In response to the aforementioned risks and challenges, I believe suggestions can be made from the following aspects:

1. Strengthen political dialogue and communication. China and Europe should adhere to the principles of equality, respect, and mutual trust, strengthen political dialogue and communication, enhance mutual understanding and trust, and eliminate misunderstandings and suspicions. At the same time, it is also necessary to actively communicate and coordinate with the United States and other countries or regions, clarify the true intentions and objectives of the "the Belt and Road" initiative, and eliminate external interference and obstacles.

2. Improve the quality and level of economic cooperation. China and Europe should fully leverage their respective strengths and potential, deepen the breadth and depth of economic cooperation, and improve the quality and level of cooperation projects. Specifically, cooperation in infrastructure, energy, digitization, green development and other fields can be strengthened, trade and investment facilitation can be promoted, stability and smoothness of industrial and supply chains can be promoted, and the challenges of epidemic impact and economic recovery can be jointly addressed.

3. Enhance social exchange and mutual learning. China and Europe should fully respect their differences in culture, religion, values, and other aspects, enhance social exchange and mutual learning, and promote mutual understanding among the people. Specifically, people to people and cultural exchanges in education, science and technology, culture, tourism, sports and other fields can be strengthened, people on both sides can improve their awareness and sense of friendship towards each other, and the social support and influence of the "the Belt and Road" initiative can be enhanced.

In short, the "the Belt and Road" initiative is an open and inclusive cooperation initiative put forward by China to promote global common development, and an important practical platform for building a community with a shared future for mankind. In Europe, the "the Belt and Road" initiative faces both important opportunities and some risks and challenges. Only by strengthening dialogue and communication, deepening practical cooperation, and enhancing people to people and cultural exchanges can we effectively address risks and challenges, promote the Belt and Road initiative to achieve more results in Europe, inject new impetus into the development of China EU relations, and contribute new solutions to global development. Therefore, to jointly build the "the Belt and Road", China and the EU need to strengthen communication and coordination, enhance mutual trust and understanding, seek common interests and the greatest common denominator of cooperation, and achieve mutual benefit and common development.

Conclusions

The world today is in a major upheaval that has not been seen in a century. Peace and development remain the themes of the times. A new round of technological revolution and industrial transformation is deepening, economic globalization is irreversible, and countries are increasingly interconnected and interdependent. Facing the future, the Belt and Road Initiative is standing at a new starting point of development. It requires all countries along the Belt and Road to work together, uphold the principle of joint consultation, joint construction and sharing, carry forward the

spirit of the Silk Road, jointly address risks and challenges, jointly consolidate, stabilize and improve the good development trend of China EU trains, promote the high-quality development of the "the Belt and Road", and work together to make greater contributions to building a community of shared future for mankind.

The economic trade and innovation cooperation between China and Europe has broad prospects and potential, but also faces some challenges and problems. In order to strengthen economic, trade, and innovation cooperation between China and Europe, I believe we can start from the following aspects:

1. Enhance mutual trust and understanding, eliminate misunderstandings and biases. Both China and Europe are important forces in technological innovation and face common global challenges. We need to strengthen communication and coordination, respect each other's development paths and interests, avoid politicizing or weaponizing technological innovation, and maintain a fair, open, and inclusive international technological innovation environment [20].

2. Expand cooperation areas and platforms, and improve the level and quality of cooperation. China and Europe have extensive cooperation space and complementary advantages in the fields of digital economy, green development, biomedicine, aerospace, etc. They can carry out joint research and development, technology transfer, talent cultivation, and other projects through the establishment of joint research centers, laboratories, bases, etc., to promote the sharing and application of scientific and technological achievements[21].

3. Strengthen intellectual property protection and rulemaking, and create a good atmosphere and conditions for cooperation. Both China and Europe attach great importance to intellectual property protection and have participated in the construction of multilateral intellectual property frameworks. Based on this, we can strengthen bilateral cooperation, promote mutual recognition and exchange of intellectual property, crack down on intellectual property infringement, and protect the legitimate rights and interests of innovative entities. At the same time, China and Europe can also strengthen rulemaking and standard coordination in emerging technology fields, form common technical norms and ethical norms, and lead the global governance of technological innovation [22].

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TECHNICAL SCIENCES

EVALUATION OF THE COMPUTER NETWORKS SECURITY LEVEL BASED ON PETRI NETS & A SET OF PARAMETERS

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Abstract

This paper presents the usage of Petri Nets system to derive a set of parameters based on the simulation numerical results. Those parameters are Reliability of Service (RoS), Defense Factor (DF), Risk Factor (RF) and Modified Risk assessment law (RM) and those parameters can be used to assess different aspects of computer networks, especially those networks that are based on the Software-Defined Networks paradigm. The numerical results are gained from simulation conducted on three modelled proposed SDN topologies, which are Serial, Parallel and Hybrid topologies and, the single-controller Ordinary topology was used as a reference point. After that comes a comparison between those three proposed topologies based on these parameters that were derived from the simulation conducted on the modelling of those same topologies. The conclusion made based on that comparison, will show the best topology that can be used by SDN paradigm and can be most reliable against different threats. Based on the proposed parameters, it was possible to measure the performance of suggested SDN topologies and the results showed that the Parallel topology is the best of all the suggested ones as compared to the Ordinary topology in terms of the four parameters.

Keywords: Distributed Denial of Service, Defense Factor, Generalized Stochastic Petri Nets, Modified Risk Assessment, Reliability of Service, Risk Factor, Software-Defined Networks.

1. Introduction

As mentioned before in other published papers [1][2], there were three SDN controllers' topologies proposed in our research, in order to overcome some issues in SDN like Single Point of Failure (SPOF) and to provide better reliability in network structure to be able to deter cyber-threats like Man In The Middle (MITM) and Denial of Service/Distributed Denial of Service (DoS/DDoS) attacks [3].

The proposed topologies are Serial, Parallel and Hybrid. The fourth topology was an existing one and widely used which is mentioned in the research for the sake of comparison and to show the advantage of the proposed topologies over the usual topology which is labeled in this research as Ordinary topology. Those topologies differ between each other in the type of interaction they have between their controllers and in the way their controllers manage the network. To the best of our knowledge there isn't much work done to measure computer networks' performance mathematically; especially Software-Defined Networks and that's why it is needed to create a method for modelling the SDN behavior; especially the behavior of the proposed topologies and use it later to assess the network structure reliability and performance against cyber threats especially, Denial of Service/ Distributed Denial of Service (DoS/DDoS) attacks.

For that purpose, this research has proposed to simulate the topologies using Petri Nets system [4] and to do that, a software called Platform Independent Petri Nets Editor (PIPE) was used to model the SDN topologies, since its work basis is the usage of Petri Nets system. After the simulation, the software grants numerical results that were used later in our research to show the performance of the proposed three SDN topologies and their advantage over the Ordinary topology. Those results were used to derive a relationship between the SDN controllers and their performance based on the monitoring of the diverse behavior patterns of those topologies against DoS/DDoS attacks and how many switch requests their controllers can deal with per unit of time.

From those mathematical relationships, it was possible to extrapolate some factors or parameters that based on them it is possible to assess various aspects of the security level of network performance. The proposed parameters are as follows:

1. Reliability of Service (RoS).
2. Defense Factor (DF).
3. Risk Factor (RF).
4. Modified Risk assessment (RM).

2. Materials used

This paper mainly discusses the usage of Petri Nets modelling of three proposed software-defined multi-controller topologies that differ in their way of interaction between their controllers and using that modelling, we'll be able to derive a set of parameters that all can be used to assess different aspects of computer networks especially, those based on SDN paradigm. Those parameters could show computer network performance against different cyber-threats like (DoS/DDoS) attacks. The modelled topologies were modelled using a software tool called Platform Independent Petri Nets Editor (PIPE) was used. PIPE is based on Markov chain and leverages petri nets system. The main module that will be used in PIPE is Generalized Stochastic Petri Nets (GSPN) to determine the feasibility and reliability of the proposed topologies. GSPN is a module of six tuples (P, T, F, W, M_0, and λ) [5].

3. Proposed algorithms

In previous paper [6], we have discussed the suggested algorithms that could be used by SDN controllers to create a more stable environment against cyber-threats like DoS/DDoS attacks. Those algorithms are as follows:

- Algorithms' suite integrated in HYDRA framework
- Secured channel of VPN algorithm
- Cryptography of Double RSA algorithm
- Distributed ledger concept of Blockchain algorithm

4. Proposed Topologies

As mentioned in previous articles like [7]; this research proposes three different topologies of Software-Defined Networks' controllers and compares them with the existing single-controller topology that was named as the Ordinary topology which was used as a reference point for comparison. The three proposed topologies are as follows:

- Serial Topology
- Parallel Topology
- Hybrid Topology

The figures below, show the proposed topologies alongside the Ordinary topology, starting with the Serial topology:

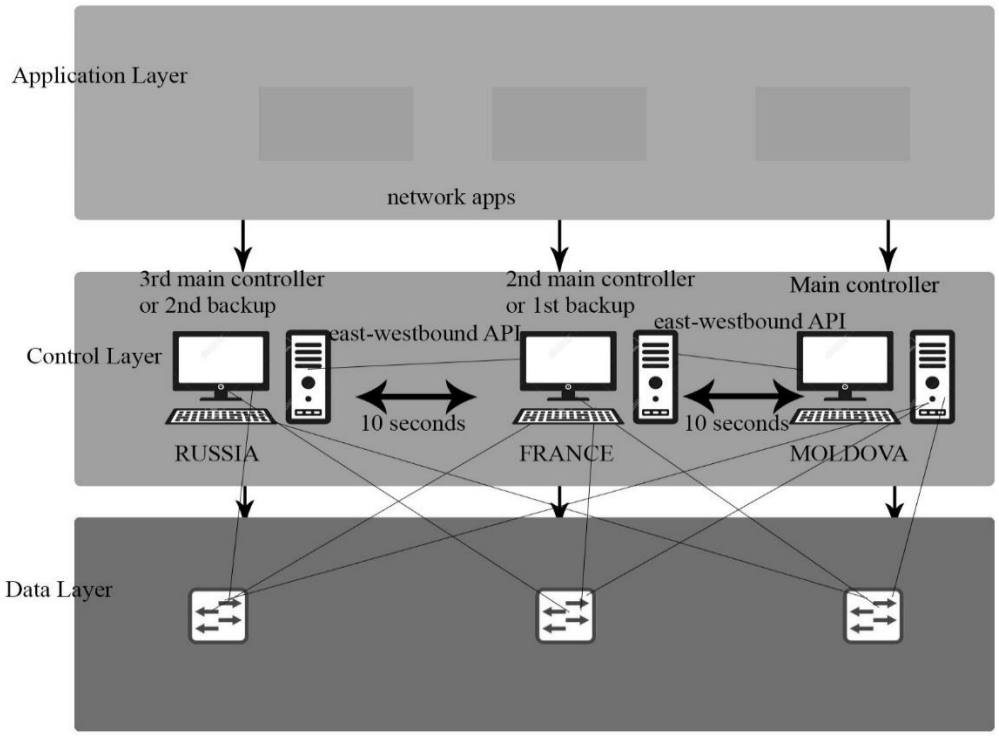


Figure 1. Structure of the Serial Topology.

And the Parallel topology will be depicted as in the following figure:

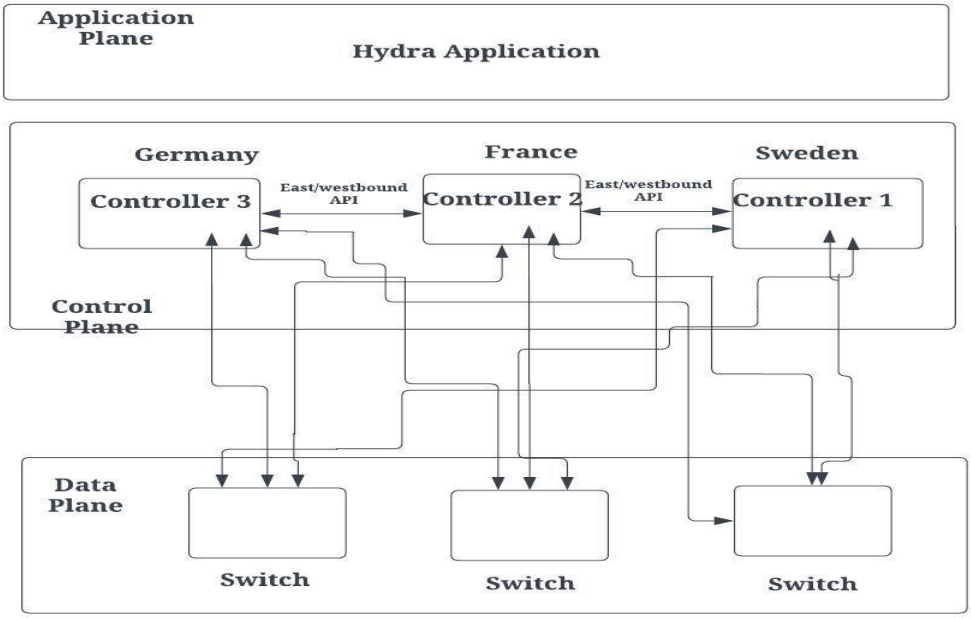


Figure 2. Structure of the Parallel Topology.

While the Hybrid topology will be shown as follows:

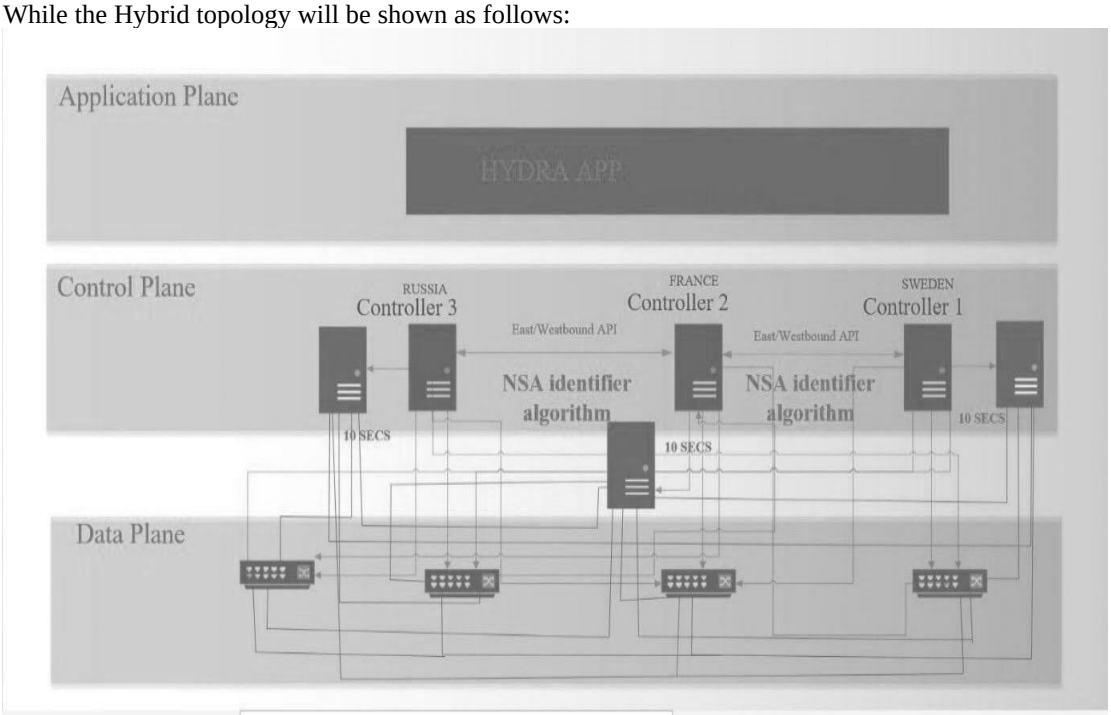


Figure 3. Structure of the Hybrid Topology.

The Ordinary topology can be depicted as in the figure below:

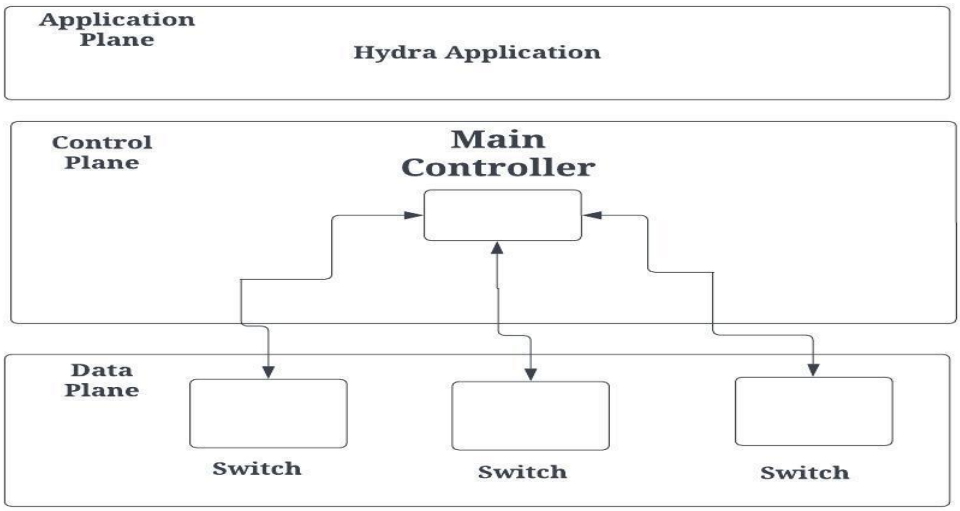


Figure 4. Structure of the Ordinary Topology.

5. Petri Nets Modelling:

Petri Nets were created in order to represent chemical reactions. For step-based procedural systems like concurrent execution systems and iteration processes, Petri nets technique provides a notation on a graphical basis. There is a mathematical explanation for this method. Petri nets' theoretical feature enables accurate modeling and analysis of system behavior [8]. In order to gain a better understanding of the topologies' capabilities and limitations as well as to extrapolate a mathematical definition from the behavior of the three proposed SDN models, this study illustrates the use of petri nets to model these SDN controller models or structures. The modelling of topologies using PIPE software can be depicted as in the following figures for the proposed topologies and the Ordinary one respectively:

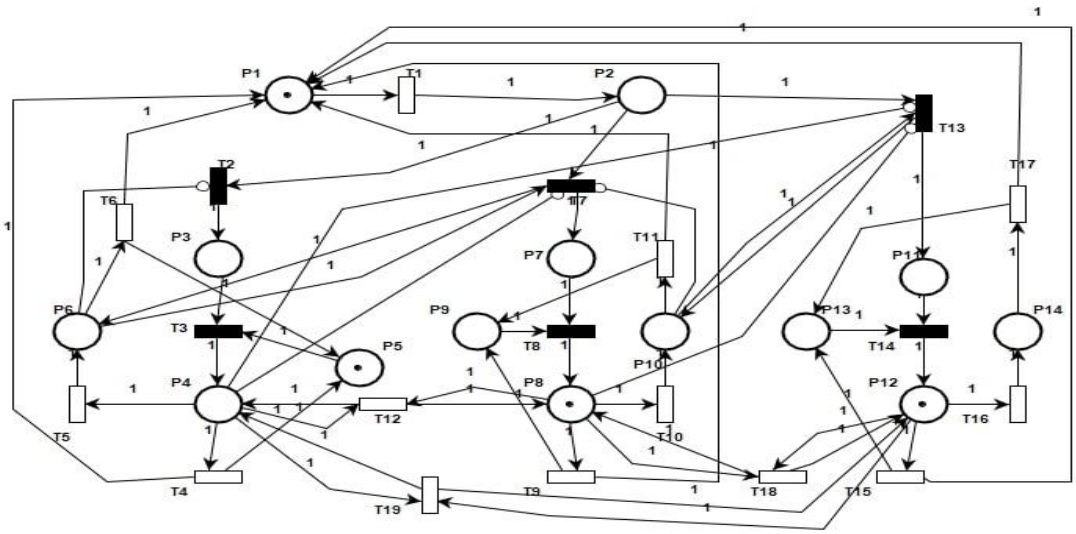


Figure 5. Serial topology modeling using Petri Nets

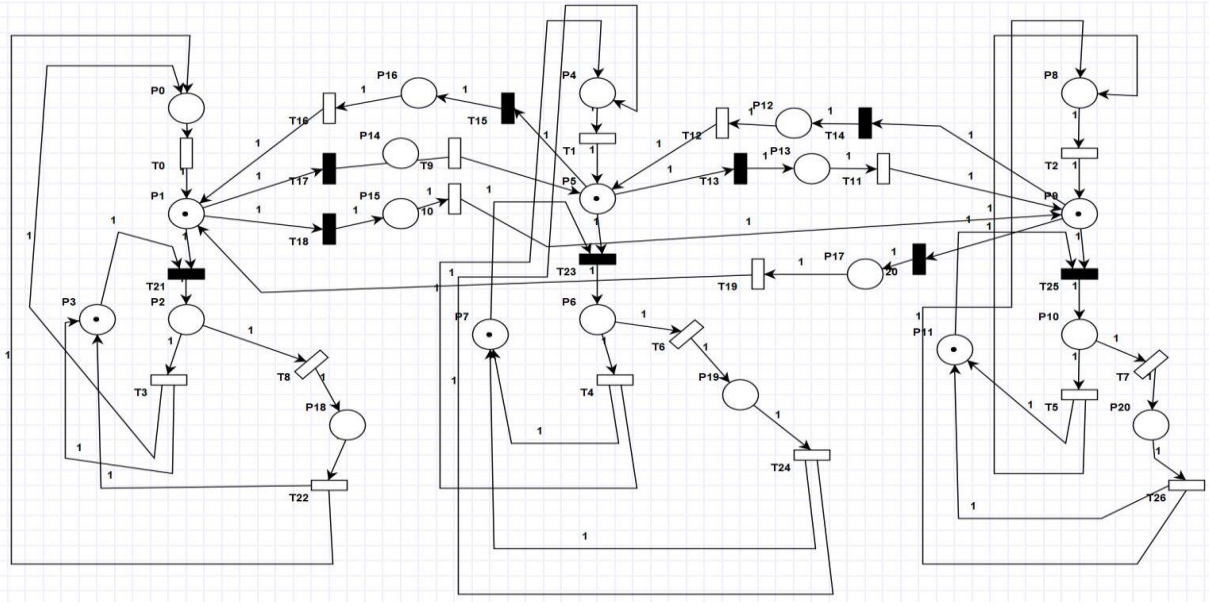


Figure 6. Parallel topology modeling using Petri Nets

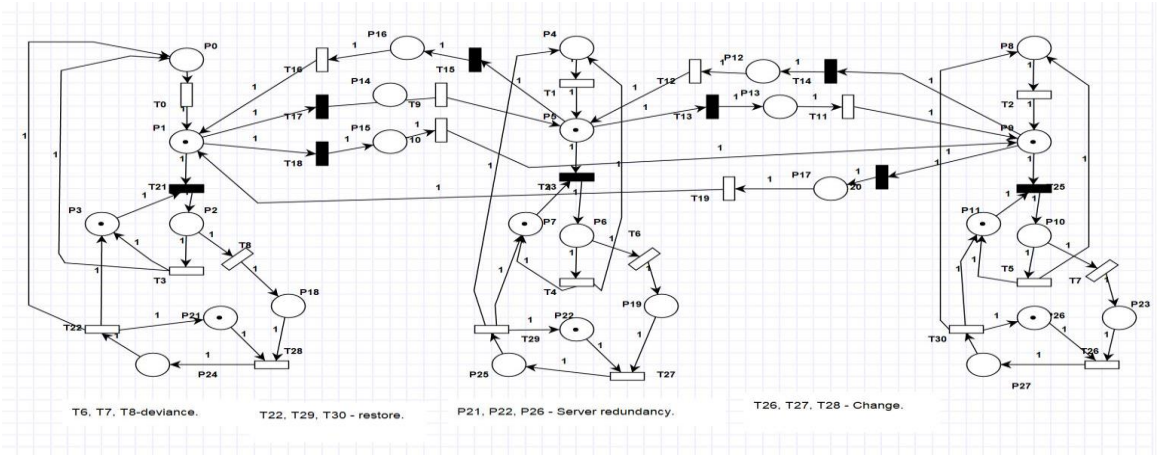


Figure 7. Hybrid topology modeling using Petri Nets

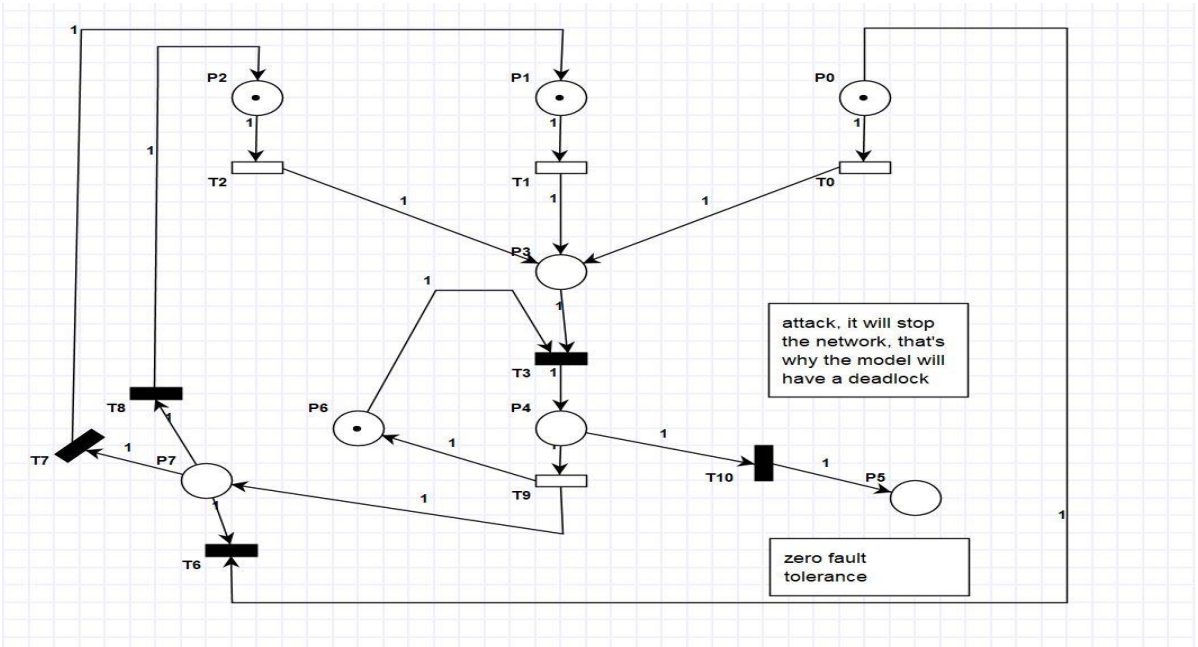


Figure 8. Ordinary topology modeling using Petri Nets

Based on the modelling of those topologies using the GSPN module option in the PIPE software, it was possible to gain the following results as shown in Table 1:

Table 1

Average Number of Tokens (distribution intensity of tokens) in Places Representing SDN Controllers Using GSPN Module

No	Places	Serial topology		Parallel topology		Hybrid topology		Ordinary topology	
		No. of controllers	Tokens Z_{Ki}	No. of controllers	Tokens Z_{Ki}	No. of controllers	Tokens Z_{Ki}	No. of controllers	Tokens Z_{Ki}
1	P1			1	0	1	0	1	2.0
2	P5			1	0	1	0		
3	P3	1	0.16						
4	P7	1	0.06						
5	P9			1	0	1	0		
6	P11	1	0.13						
7	P21					1	0.90		
8	P22					1	0.90		
9	P26					1	0.90		
Total		3	0.36	3	0	6	2.71	1	2.0

Based on the modelling results of those topologies, it was possible to extrapolate four main security parameters that based on them, it's possible to evaluate the performance of the computer networks that are based on the SDN paradigm, especially those that based on the proposed models. The proposed factors or parameters are:

- Reliability of Service (RoS).

Is an expression added in this research to describe the performance reliability of data protection. Reliability of Service (RoS) could be close to Quality of Service (QoS) which is the definition of the performance of any system's service, like a computer network or a cloud computing, etc. The SDN has many positive features. These features have attracted the attention of researchers to improve the QoS provisioning of today's various network applications [9]. But RoS is a little bit different and has a more detailed specification tailored for the needs of SDN. This work proposes to measure the RoS as follows:

$$RoS= 1- TANR / TANR_O \quad (1)$$

Where TANR is the Total Average Number of network requests of the proposed topologies, which is the summation of all averages after dividing them by the number of these averages and that means how many requests per server and shows the risk occurrence level. The $TANR_O$ is the Total Average Number or intensity of requests in controller of Ordinary topology.

- Defense Factor (DF).

To determine the strength and security feasibility of the network against DoS/DDoS attacks. In terms of Petri Nets, the requests will be represented by how many tokens are there in specific places which in turn represent specific nodes in the software-defined network and those specific nodes of interest are the SDN controllers. In the equation (4) places representing the SDN controllers are denoted as K_i where $K \in P$, P is the whole group of places in the Petri Nets (PN) model, which in turn is a tuple of 5 objects, PN = {P, T, I, O, M_0}, where P is the finite set of places, T is a finite set of transitions, I is the input function, O for output function and M_0 is the initial marking.

$$K = \sum_{i=1}^{i=n} Ki,\ K_i \in \{1 - n\} \quad (2)$$

$$Z= \sum_{i=1}^{i=n} Zi,\ Z_i \in \{0 - \infty\} \quad (3)$$

$$DF = [\sum_{i=1}^{i=n} Ki] / [\sum_{i=1}^{i=n} Zi] = \sum_{i=1}^{i=n} [\frac{Ki}{Zi}] \quad (4)$$

The Defense Factor DF equation depends mainly on the assessment of the strength of software-defined network's controllers based on their emptiness and that means their readiness and availability to deter any kind of DoS/DDoS attack. Therefore, it is logical to say that the more controllers we have the better the network's capability it is to deter those attacks. That means the more controllers the better and the higher DF value it is, and that explains why the DF equation has the places that represent the controllers in numerator position because the number of controllers is proportional to the value of the DF.

While on the other hand we can see that the more tokens that represent the requests, the weaker the network gets and that means the less DF value we will get.

So, the DF value and the number of tokens or requests are inversely proportional and that's why they should be put in the denominator position. In addition, it is mentioning worthy that if we reversed the DF then, meaning if we divided the tokens/requests by the places/controllers then we'll get how many requests per server meaning; it will divide them equally and that could be unrealistic, because based on the types of reactions between the controllers in every topology; a controller could be dealing with more requests while the other is just waiting as a backup controller.

- Risk Factor (RF).

To figure out the weakness level of the network environment. The values of the Total Average Number (distribution intensity) of Requests (TANR), can be described as the Risk Factor. Since we need to find the strength and defense ability of the network controllers to deter the DoS/DDoS attacks and the more PN tokens/ network requests controllers have per unit of time, the more occupied the controllers will be and the weaker they will be and this shows the weakness point or risk level of the network.

So, this paper shows the proposes the Risk Factor (RF) parameter to evaluate the efficiency of the elaborated topologies. The relationship that depicts the parameter is as follows:

$$RF= 1/ DF \quad (5)$$

Where DF, is the Defense Factor value of the measured topology. The parameter RF will still be the opposite of what we need to figure out, which is the TANR also. So, the quantity number of PN places/SDN controllers should be in the numerator and the Petri Nets tokens/ network requests should be in the denominator and that is another logical proof of why there was a need to derive that formula and to put it in that form.

- Modified Risk assessment (RM).

To assess the security level of software-defined networks based on the risk assessment law, it is possible to modify it for the needs of SDN and after modifications, it's called the modified law of security risk assessment (RM). By applying the security risk assessment law [10] to evaluate the protection level of the computer networks, which states:

$$R= P_0 * V \quad (6)$$

Where R is the security risk assessment that quantifies and shows the possibility of a threat acting upon a vulnerability successfully and the severity of the results of that attack, P_0 represents the initial probability or likelihood of the vulnerability occurrence and V represents the value or cost of the asset.

In other words, using this formula we can estimate how much the proposed framework will reduce the security risk of a computer network, hence assuring its security. Since a server is the most important part and has the highest value node in the network environment, in which we will install our controller software, then we can say it has the highest asset value or impact. The servers have the value V=100 as an asset impact [10], because it is the value of server's impact on the secure socket layer (SSL) which is the same layer which the OpenFlow protocol works through.

The probability of vulnerability $P_0 = 0.025$ which is measured based on the lost orders due to the web server denial of service attack. It is possible to acquire a new value of probability P_n, which will be affected by the DF mathematically as shown:

$$P_n=P_0 / DF \quad (7)$$

The higher Defense Factor, the better which is the opposite of the probability of vulnerability; that means that they should be inversely proportional mathematically as they're logically and that's why they're positioned this way in the formula of finding the new likelihood or probability of vulnerability.

It is possible to estimate that our framework and the formula derived from its modeling, will reduce the likelihood of attacks occurrence (like DoS/DDoS attacks) and for that we propose a modified version of Security Risk Assessment parameter and it will be as:

$$RM = P_n*V \quad (8)$$

6. **Comparison of parameters of SDN topologies security assessment**

Eventually there is a need to provide an analytical comparison of the proposed parameters of computer networks security assessment based on the suggested topologies and the results of their simulation. The data are presented in Table 2, where RoS is the Reliability of Service, DF is the Defense Factor, RF is the Risk Factor, RM is the Modified security Risk assessment.

Table 2

The values of RoS, DF, RF, RM and cost for the proposed topologies

No.	Topology	RoS	DF	RF	RM
1	Serial Topology	0.94	8.23	0.12	0.3
2	Parallel Topology	1.0	∞	0	0
3	Hybrid Topology	0.78	2.21	0.45	1.1
4	Ordinary Topology		0.50	2.0	5.0

From the data presented in Table 2, it is possible to infer that the Parallel topology is the best one from the point of view of all security estimation parameters, after that comes the Serial topology and the Hybrid topology is the last one.

The usage circumstances of these parameters differ from each other. When it is needed to measure the data protection performance then, it is possible to apply the RoS parameter, where it is possible to infer that the reliability of service of the serial topology is 0.94 of the previous Reliability of service of the single-controller ordinary topology, the parallel topology gained a 100% enhancement as compared to the ordinary topology and the hybrid topology proved to be better than the ordinary topology as well in terms of reliability of service by 0.78.

In other words, it is possible to say that the best topology of all the proposed topologies in terms of RoS, is the parallel topology.

When there's a need to determine the defense ability and the network's strength against DoS/DDoS attacks then, it is possible to depend on the DF parameter. Where the defense factor that shows the strength of presented SDN topologies against DoS/DDoS attacks has the value of 8.23, while the parallel topology has a very high value close to ∞ since the number of the tokens that represent network requests in its controllers, are very small and close to 0 most of the processing time and that means that the defense factor value of this topology is close to optimal, meaning the parallel topology is nearly most reliable against DoS/DDoS attacks, the hybrid topology has a value of 2.21 and last but not least the ordinary topology has the least value which is 0.50, meaning that the single-controller topology has the weakest structure against DoS/DDoS attacks.

While if there was a need to reverse the situation and figure out the weakness of the network then, it is possible to reverse the parameter and use the RF which is the inversely proportional to DF. So that means the

higher the value, the worse it is. It is possible to conclude that the serial topology has the value of 0.12, the risk factor value of the parallel topology is 0 since it is nearly optimal and that means this structure has low risk, the hybrid topology has a risk factor of 0.45 and least but not last the ordinary topology has the highest value of 2.0, which refers to the high jeopardy the comes along the usage of this topology.

In case there was a need to measure the SDN environment weakness based on the computer networks law, then it is possible to modify it to be used based on the proposed SDN environments and their Petri Nets modeling and in this case the RM parameter can be used. This parameter is a proof of how the DF equation has assured the security of the proposed topologies and reduced the risk value as compared to the already existing ordinary topology in terms of the risk assessment law that is used to describe the security risk for computer networks in general. So after modifying the risk assessment law by incorporating the effect of the Defense Factor in its equation to create a new parameter called the Modified Risk parameter, the research shows that the serial topology has a reduced RM value of 0.3, the parallel topology has a value of 0 as well hence, it is the best topology of all the suggested topologies, the hybrid topology's RM value is 1.1 and the single-controller topology has a value of 5.0 and this high RM value of the ordinary topology shows the security enhancements, the proposed topologies have in their design over the ordinary topology.

The novelty of these proposed parameters stems from their basis, which is the modeling of the suggested SDN topologies using Petri Nets (PN) system to simulate their behavior and to acquire numerical results from that. Based on these numerical results, those parameters were provided.

Alongside the algorithms, topologies, and their Petri Nets modeling, this research provides mathematical mechanisms to evaluate the security level and data protection performance of computer networks based on SDN technologies.

7. Conclusions

This work concentrates on increasing the software-defined network's protection hence, turning SDN into a more protected environment, leading to protecting networks generally if those networks leverage the SDN structure.

The paper here, shows a brief description of the proposed algorithms and topologies suggested for Software-Defined Networks' controllers to overcome some issues that SDN paradigm is facing like Single Point of Failure (SPOF), Denial of Service/Distributed Denial of Service (DoS/DDoS) and (MITM) attacks.

After that, this paper gives modelling for the proposed SDN topologies using Petri Nets (PN) system. The proposed topologies are named as the Serial, Parallel and Hybrid topologies. Also, for the sake of comparison, there was another modelling given for an existing single-controller topology named in this research as the Ordinary topology.

The PN modelling was conducted using Platform Independent Petri Nets Editor (PIPE) software that has many modules including Generalized Stochastic Petri Nets (GSPN) module which is the one that was used.

Findings: the numerical results gained from the GSPN module were used to extrapolate mathematical tools that were measuring the security and performance level of computer networks based on four parameters. Those parameters are Reliability of Service (RoS), Defense Factor (DF), Risk Factor (RF) and Modified Risk assessment law (RM). Based on those parameters it's possible to estimate the reliability of SDN-based computer networks against some cyber-threats like DoS/DDoS attacks.

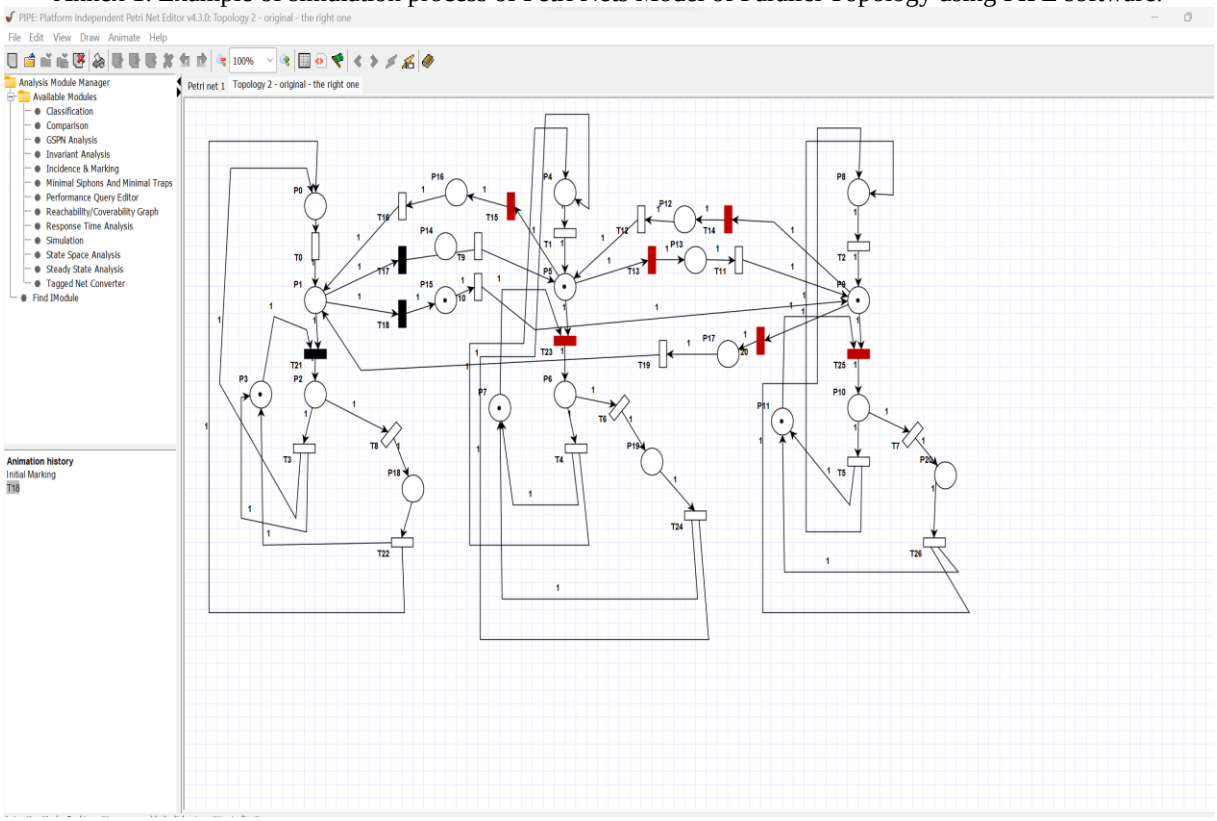
Research limitations/implications: this paper opens the discussion *about* the measurement of network security and the ability to model network risk using different performance evaluation parameters which could be used to determine the network ability to deter cyber-attacks especially DoS/DDoS attacks.

Practical implications: this paper argues about the ability to use the results acquired from the Generalized Stochastic Petri Nets (GSPN) module in the PIPE software to derive parameters that can measure the level of network performance and deterrence ability against DoS/DDoS attacks.

Originality/value: of the work is determined by the developed formulas, which have a big contribution for the SDN community by figuring out a way to deal with the issue of modelling software-defined network's performance using a set of parameters and topologies.

Conflicts of Interest: The author declares no conflict of interest.

Annex 1. Example of simulation process of Petri Nets Model of Parallel Topology using PIPE software.

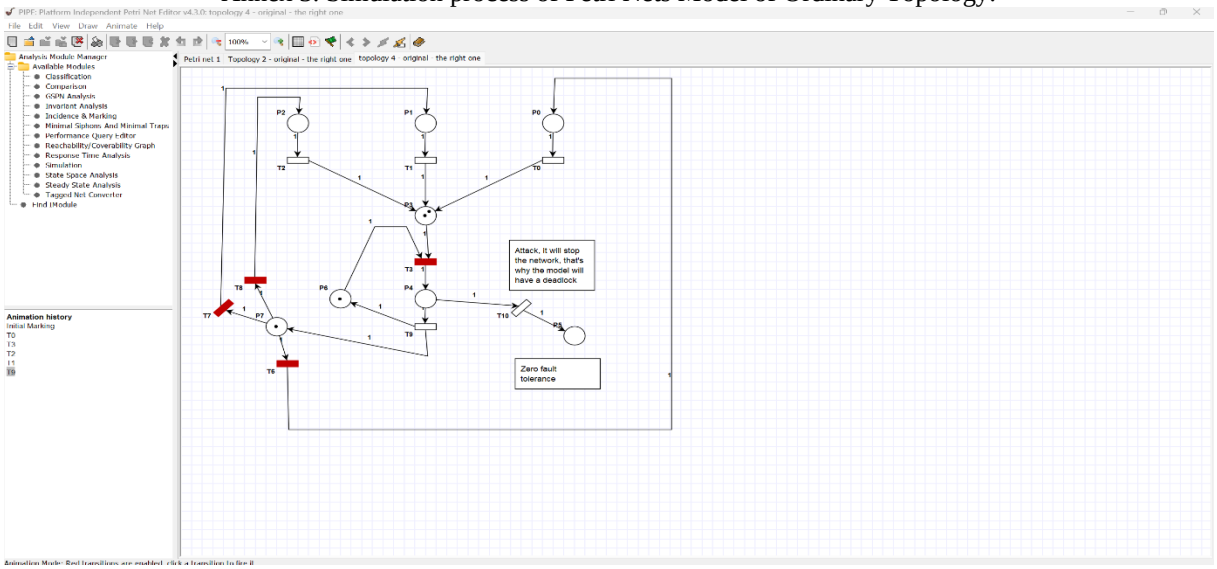


Annex 2. Table showing the Average number of tokens (network requests) on a place (main controller) for the Parallel topology as an example.

Average Number of Tokens on a Place

Place	Number of Tokens
P0	0.23658
P1	0
P10	0.10948
P11	0.78103
P12	0.32674
P13	0.32664
P14	0
P15	0.32669
P16	0.32663
P17	0.32674
P18	0.1093
P19	0.10933
P2	0.1093
P20	0.10948
P3	0.78139
P4	0.23664
P5	0
P6	0.10933
P7	0.78134
P8	0.23711
P9	0

Annex 3. Simulation process of Petri Nets Model of Ordinary Topology.



Annex 4. Table showing the Average number of tokens (network requests) on a place (main controller) for the Ordinary topology.

Average Number of Tokens on a Place

Place	Number of Tokens
P0	0
P1	0
P2	0
P3	2
P4	0
P5	1
P6	0
P7	0

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РОЗВИТОК БІЗНЕС-СЕРЕДОВИЩ З ВИКОРИСТАННЯМ ШТУЧНОГО ІНТЕЛЕКТУ

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USE OF ARTIFICIAL INTELLIGENCE FOR ANALYSIS OF MARKET TRENDS AND PREDICTION OF CHANGES IN THE BUSINESS ENVIRONMENT

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Анотація

Ця стаття присвячена актуальній темі використання штучного інтелекту у сфері ринкових відносин для принесення прибутку та розширення малого та середнього бізнесів. Згідно з вимогами сталого розвитку, державні та приватні підприємства повинні адаптуватися до мінливих умов та використовувати новітні технології. Стаття аналізує концепції "аналізу ринку", "трендів" та "етичного використання ШІ". Застосування ШІ в галузі інформаційно-комунікаційних технологій може підвищити прибуток компаній та задоволення потреб громадян і бізнесу.

Abstract

This article is devoted to the current topic of using artificial intelligence in the field of market relations to bring profit and expand small and medium-sized businesses. According to the requirements of sustainable development, public and private enterprises must adapt to changing conditions and use the latest technologies. The article analyzes the concepts of "market analysis", "trends" and "ethical use of AI". The application of AI in the field of information and communication technologies can increase the profits of companies and satisfy the needs of citizens and businesses.

Ключові слова: сучасне підприємство, маркетингові дослідження, маркетинг, інноваційні підходи, штучний інтелект.

Keywords: modern enterprise, marketing research, marketing, innovative approaches, artificial intelligence.

Вступ. Штучний інтелект (ШІ) – це галузь комп'ютерної науки, що займається створенням програм та алгоритмів, які можуть моделювати людський інтелект. ШІ кардинально змінив ситуацію у світі бізнесу. Однією з ключових сфер широкого застосування ШІ є аналіз ринкових тенденцій і прогнозування змін у бізнес-середовищі. Штучний інтелект трансформує способи роботи компаній, надаючи величезну кількість інформації та ідей, які можуть допомогти їм приймати обґрунтовані рішення, покращувати свою діяльність і залишатися попереду конкурентів.

Одна з ключових переваг штучного інтелекту є швидкість обробки великих обсягів даних. Алгоритми ШІ можуть швидко просіювати дані з різноманітних джерел, таких як соціальні мережі, стрічки новин та онлайн-огляди, щоб визначити закономірності та тенденції. Це може допомогти компаніям отримати уявлення про поведінку, уподобання та настрої споживачів, що може вплинути на їхні маркетингові стратегії та розробку продукту[1].

Використання ШІ. Можливо виділити три основні сфери, де за допомогою штучного інтелекту, бізнес здатен перейти на новий рівень, а саме:

1. Оптимізація операційної аналітики на основі єдиної інтелектуальної платформи;
2. Нові можливості для ефективної праці трудових ресурсів;
3. Максимізація рентабельності інвестицій завдяки рішенню, яке одночасно розвивається у ході бізнес-процесів.

Прогнозна аналітика на основі інтеграції штучного інтелекту у клієнтські та корпоративні програми заощадить час та ресурси компанії у ході різноманітних операцій. Використання централізованої платформи на основі штучного інтелекту допоможе:

1. Ефективно аналізувати товарні запаси та виконання замовлень, щоб зменшити витрати на утримання складу, мінімізувати затримки доставки, контролювати знижки;
2. Формувати пропозицію відповідно до бажань клієнта ще до того моменту, як він їх оголосить, забезпечуючи завжди актуальним асортиментом у магазині;
3. Мати доступ до єдиної бази даних про клієнтську карту;
4. Уникати шахрайства з платіжками та кібератак;

5. Синхронізувати асортимент у різних точках продажу, щоб забезпечувати клієнтам вибір у можливих локація для забирання оплаченого товару.

Враховуючи той факт, що нині машини витісняють живих людей та нівелюють певні професії, технологія повинна допомагати тим же працівникам проявляти їх інші здібності та проявляти винахідливість. Штучний інтелект допомагає продавцям супроводжувати клієнтів високоякісним сервісом на всіх етапах його шляху до покупки, підвищуючи його продуктивність. Рішення ШІ оптимізуються відповідно до кожного співробітника організації, використовуючи хмарні інструменти для підвищення їх ефективності та впевненості у роботі. Прикладом такої взаємодії стає економія балансу робочого часу працівника та отримання нових умінь, оскільки за дослідженнями, 65% фонду робочого часу займають буденні завдання з якими мережа систем справляється набагато швидше[2].

ШІ також використовується для аналізу настроїв ринку та прогнозування змін у поведінці споживачів. Аналіз настроїв передбачає використання методів обробки природної мови (NLP) для аналізу публікацій у соціальних мережах, відгуків клієнтів та інших джерел відгуків клієнтів, щоб оцінити загальне ставлення до певного продукту, бренду чи галузі. Аналізуючи настрої, компанії можуть отримати уявлення про вподобання клієнтів і прийняти обґрунтовані рішення щодо розробки продуктів і маркетингових стратегій[3].

Окрім аналізу ринкових тенденцій, ШІ також використовується для моніторингу та аналізу конкурентів. Відстежуючи діяльність конкурентів, підприємства можуть отримати уявлення про їхні стратегії, сильні та слабкі сторони та використовувати цю інформацію для формування власної стратегії. Алгоритми штучного інтелекту можуть допомогти компаніям аналізувати дані про конкурентів із різних джерел, таких як соціальні мережі, стрічки новин і ринкові звіти, для визначення тенденцій та закономірностей.

Штучний інтелект став важливим інструментом інвестування в акції, оскільки він дозволяє інвесторам обробляти великі обсяги даних і приймати обґрунтовані інвестиційні рішення на основі прогнозної аналітики[4].

Ще однією перевагою використання ШІ є можливість автоматизації процесу. За допомогою автоматизованих алгоритмів, ШІ може аналізувати та інтерпретувати дані без необхідності втручання людини. Це дозволяє економити час та зменшувати можливість людської помилки при аналізі даних.

Однак, використання ШІ має свої виклики. Одним з найбільших викликів є необхідність забезпечення точності та достовірності даних. ШІ може бути помилковим, якщо йому надати неточні або недостовірні дані. Крім того, ШІ не завжди може інтерпретувати складні та суб'єктивні дані, такі як смак та естетичні переваги.

Ще одним викликом є етичні питання використання ШІ. ШІ може збирати та обробляти величезну кількість особистих даних про користувачів, що може порушувати їхні приватність та безпеку. Крім того, використання ШІ може вплинути на зайнятість та змінити природу роботи в бізнесі.

За даними досліджень, прогностичні моделі сьогодні є найвигіднішими. З їх використанням можна опрацювати великі дані про поведінку потенційних споживачів, агрегувати дані не тільки щодо їх онлайн-поведінки, а й зі смарт-носіїв, з якими вони взаємодіють. Сьогодні, джерелами інформації в маркетингових дослідженнях можуть бути як дані про покупки клієнта, так і про поведінку, не пов’язану із придбанням товару чи послуги.

Крім аналізу ринкових тенденцій штучний інтелект має широке застосування в багатьох галузях: медицині, транспортних технологіях та інших. Не можна не відзначити застосування ШІ в ігровій індустрії. Ця техніка передбачає використання алгоритмів для створення елементів гри, таких як рівні, квести та навіть цілі світи, на основі набору попередньо визначених правил. Це дозволяє розробникам створювати великі, різноманітні та привабливі ігрові середовища без необхідності вручну проектувати кожен аспект гри. ігри тепер використовують алгоритми, керовані штучним інтелектом, для аналізу поведінки та вподобань гравців, що дозволяє їм адаптувати ігровий досвід для окремих гравців. Це може включати коригування рівнів складності. Крім того, розробники можуть використовувати інструменти на основі штучного інтелекту для оптимізації різних аспектів створення ігор, від проектування персонажів і середовища до тестування та налагодження. Розробники можуть приділити увагу створенню більш складного та цікавого контенту для гравців. Штучний інтелект також застосовується у створенні більш реалістичного та привабливого ігрового середовища. У багатьох сучасних іграх є розумні персонажі, які можуть думати та реагувати на дії гравця в реальному часі. Це робить гру більш складною та захоплюючою, оскільки гравці повинні адаптуватися до мінливої ситуації. Часто в ігровій індустрії застосовується так званий слабкий штучний інтелект (вузький ШІ) – це штучний інтелект, який реалізує певну частину своїх можливостей, тобто зосереджений на одній вузькій сфері. Він застосовується для вирішення певного класу задач. Сильний штучний інтелект (СШІ), або загальний штучний інтелект, або штучний генералізований інтелект (AGI) – це штучний інтелект, який може успішно виконати будь-яку інтелектуальну задачу, котру може виконати людина. Сильний ШІ зможе розвиватись майже експоненціально і за долі секунди перевершити здібності людського розуму в десятки чи мільйони разів. Треба зазначити, що при створення відеоігор використовується так званий ігровий штучний інтелект – це набір програмних методик, які використовуються у відеоіграх для створення ілюзії інтелекту в поведінці персонажів, керованих комп'ютером. Так алгоритми машинного навчання можуть створювати індивідуальні ігрові стратегії для кожного гравця, що враховують його особливості та ігровий стиль. Ще одна сфера, де штучний інтелект значно вплинув на ігрову індустрію це адаптивний геймплей. Адаптивний геймплей означає здатність гри регулювати складність, темп і механіку на основі рівня навичок і вподобань гравця. Це досягається завдяки використанню алгоритмів машинного навчання, які аналізують поведінку гравців і в режимі реального часу коригують параметри гри. Нейромережі можуть до-

помогти визначати поведінку гравців та створювати ігрових персонажів, які можуть взаємодіяти з гравцями на більш реалістичному рівні. Ігровий ШІ крім методів традиційного штучного інтелекту, включає також алгоритми теорії керування, робототехніки, комп'ютерної графіки та інформатики у цілому.

Конкуренти ШІ. Серед актуальних інструментів пошуку та збирання інформації також виокремлюють вже популярні SMM, SEO та широке використання «мобільної реклами» [5]. SMM (social media marketing) – метод маркетингу, що спеціалізується на використанні соціальних мереж для функціонування спільнот осіб, зацікавлених у певній тематиці, збуту продукції, покращення іміджу, спілкування та вивчення потреб цільової аудиторії [6].

Соціальні мережі, які забезпечують підприємствам прямий контакт із цільовою аудиторією, уможливлюють також детальне вивчення цієї аудиторії. Правильне використання цього інструменту дає маркетологам змогу створювати спільноти прихильників та лояльних споживачів, розвивати розуміння образу та пріоритетів споживача, способів прийняття рішень про покупку. SEO (search engine optimization) – метод маркетингу, що передбачає оптимізацію та налагодження видавання інформації про компанію в пошукових системах мережі Інтернет [7]. Використання SEO забезпечує диференціацію підприємства в Інтернет та розуміння семантичних запитів клієнтів. SEO-аналітика надає підприємствам інструменти аналізу потоку, можливість експериментувати із контентом та наданням ціннісної пропозиції підприємства в Інтернет.

Технології «мобільної реклами» – комплекс інструментів взаємодії із сегментами споживачів через мобільні пристрої. Смартфон вже зайняв першу сходинку в переліку каналів комунікації підприємства та споживача. Саме тому сьогодні більшість підприємств середнього та великого масштабу розробляють додатки для власної компанії, мобільні версії веб-сторінок, чат-ботів, активно використовують додану реальність у комунікаціях та представленні продукту. Швидкими темпами розвиваються стартап-компанії, орієнтовані на збирання інформації про споживача з використанням мобільних пристроїв.

Перелічені технології на сьогодні актуальні та активно використовуються для цілей підприємств. Вже відома, проте недостатньо представлена в маркетингових дослідженнях зовсім інша група технологій, які можуть революційно змінити бачення та інструментарій маркетингових досліджень у майбутньому. Беручи до уваги все більше залучення людей до онлайн-середовища та можливі періоди ізоляції людей від переміщення в непередбачуваних обставинах, використання новітніх онлайн-технологій у маркетингових дослідженнях є не тільки можливістю, але й необхідністю, зважаючи на істотне зростання можливостей штучного інтелекту, позиції якого в маркетингу ставатимуть дедалі міцнішими.

Висновки. Загалом використання штучного інтелекту в аналізі ринкових тенденцій і прогнозуванні змін у бізнес-середовищі дає підприємствам багато переваг. Надаючи своєчасну та точну інформацію, штучний інтелект може допомогти підприємствам приймати обґрунтовані рішення, покращувати свою діяльність і залишатися попереду конкурентів. Синергія ШІ та стратегічного управління – це потужний інструмент для максимізації потенціалу бізнесу. Інтегрувавши ШІ у стратегічне управління, бізнеси можуть використовувати обґрунтовані дані, автоматизувати рутинні завдання та передбачати майбутні тенденції. Хоча існують виклики, пов’язані з впровадженням ШІ, переваги значно переважають недоліки. Впровадження штучного інтелекту у різні галузі діяльності людини – економічної, технічної, медичної, соціально-культурної та ін. відкриває принципово нові можливості для людини. Так застосування штучного інтелекту в різних аспектах ігрової індустрії становиться все більш потужною і вирішальною Оскільки технологія ШІ продовжує розвиватися, можна очікувати ще більше інноваційних застосувань ШІ в різноманітних бізнес-середовищах.

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POLISH JOURNAL OF SCIENCE
№68 (2023)

ISSN 3353-2389

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