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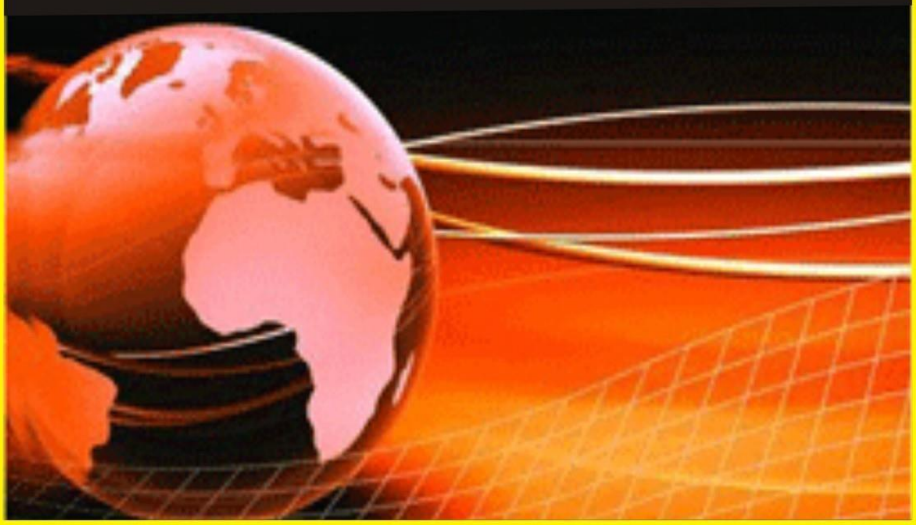

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VISION

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A STUDY ON INDIAN STOCK MARKET VOLATILITY

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ABSTRACT

A major topic in financial economics, stock market volatility reflects the unpredictability, swings, and dynamic behaviour of security prices. Due to its integration with international financial systems, sensitivity to domestic macroeconomic developments, and predominance of retail investor participation, the Indian stock market—one of the biggest and fastest-growing among emerging economies—displays distinctive volatility patterns.The rate of inflation, economic crises, social and political factors, shifts in economic policy, economic indicators, and other factors are some of the causes of stock market volatility. Many measures are taken, such as margin trading, pre-open sessions, price bands, circuit breakers, etc., to reduce the impact that these factors cause. This study offers a theoretical investigation of the volatility of the Indian stock market, emphasising its causes, consequences, and connections to behavioural and macroeconomic variables.A theoretical and secondary research approach is used in this study. The study emphasises how domestic policy decisions, global shocks, sectoral movements, and investor sentiment shape volatility in the Indian context.In addition to highlighting the ways in which volatility interacts with economic fundamentals, this paper develops a broad theoretical framework that explains how volatility arises and endures in India's equity markets. It does this by drawing on theories of volatility modelling, efficient market hypothesis, behavioural finance, and global contagion perspectives.

KEYWORDS: *Stock Market, Volatility, Macroeconomic, Investor, Finance, etc.*

1. INTRODUCTION

The degree of fluctuation in asset prices over time is known as stock market volatility, and it is frequently used as a stand-in for risk and uncertainty. Although volatility is a common occurrence, the Indian stock market offers a unique example because of its developing market features, changing regulatory environment, growing interconnectedness with international markets, and extreme sensitivity to domestic political and economic events (Bekaert & Harvey, 1997).Price fluctuations are correlated with market volatility; the more frequent and significant the price fluctuations, the smaller the market's losses. Major domestic and international events, including the Asian financial crisis (1997), the dot-com bubble (2000), the global financial crisis

(2008), demonetisation (2016), the COVID-19 pandemic (2020), and the post-pandemic recovery (2021 onwards), have historically caused significant volatility in the Indian stock market. These swings show that behavioural and structural factors frequently drive volatility in India rather than just reflecting fundamentals. An exceptionally rich context for studying volatility is offered by the Indian stock market. India has transformed from a comparatively closed financial system to one of the most active emerging equity markets over the last three decades, and it currently ranks among the top exchanges in the world by market capitalisation.It is not just academically necessary to comprehend Indian stock market volatility. Monitoring volatility is essential for regulators like the Reserve Bank of India (RBI) and the Securities and Exchange Board of India (SEBI) to create policies that maintain stable markets and avert systemic instability. Theoretical understanding of how volatility arises and how to control it forms the basis of tools like circuit breakers, margin requirements, and disclosure standards.India presents a special case for examining the theoretical underpinnings of volatilitybecause of its dual character as globally integrated and institutionally distinct markets.The goal of this paper is to theoretically explain the volatility of the Indian stock market.

Objectives of the study:

- To investigate the idea of stock market volatility and its theoretical underpinnings.
- To investigate how domestic policy, international shocks, and macroeconomic indicators affect volatility.
- To draw attention to how volatility affects investors, regulators, and policymakers.
- To offer theoretical perspectives on controlling and comprehending volatility in developing markets such as India.

2. LITERATURE REVIEW

- **Dr. Debesh Bhowmik (2013)** used relevant financial literature to study a variety of aspects of stock market volatility, such as how it is measured and what kinds of effects it can have. They came to the conclusion that economic depression and political upheaval exacerbated stock market volatility, which slowed the nation's growth rate and had a negative effect on growth rates abroad.
- **Dhingra, Gandhi, and Bulsara (2016)** made an effort to investigate how volatility and stock market returns interact. The Impulse Response Function, which was based on Vector Autoregression, showed that foreign institutional investments had a destabilising effect on stock market volatility through their impact on selling activities.
- **M. Pushpalatha, J. Srinivasan, and G. Shanmugapriya(2019)** investigated the volatility of the Indian stock market, concentrating on the Nifty index and a few companies from the National Stock Exchange's (NSE) financial services sector. They discover that the volatility of individual financial service companies varies greatly, and that the Nifty index is more volatile than the chosen financial service companies.
- **Mukherjee (2011)** investigated whether the stock market volatility of developed and emerging markets has a significant impact on the volatility of stock returns in India. The findings showed that while Hong Kong and China have a negative impact on Indian stock market returns, the United States and the Republic of Korea have a positive impact.

- **Agarwale, Astha (2020).** This study looks at the volatility trends of India's National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). According to the author, the BSE and NSE show comparable patterns of volatility; however, because the BSE is more volatile, investors who use it to invest are at higher risk.
- **Gahlot (2014)**examined the characteristics of volatility and volatility spillover among South Asian nations.He discovered a short- and long-term bilateral causal relationship between the US and India. Furthermore, it has been discovered that the permanent component of volatility is more susceptible to shocks during a recession.
- **Khan A. A. & Zia A. (2019)** looked into how the announcement of SBI and its affiliate banks' mergers affected the volatility of SBI stock returns. The study covered a time period of 300 days (the event window) and employed the GARCH model. The study made use of secondary data from trustworthy sources. The study's findings demonstrated that, in various ways, mergers and acquisitions were the cause of the rise in stock return volatility.
- **Kothari (2016)** to determine the elements influencing volatility in the Indian stock market, looked at investor perception. Factor analysis and multiple regression modelling were among the models used for the analysis of the study's primary data. The study found that the Indian stock market displayed a high level of volatility. It was discovered that external factors had the biggest influence on stock market volatility, followed by stock market and company-specific factors.
- **Verma and Kumar (2012)** used OLS regression to examine the impact of the month of the year on the return series of the BSE Sensex and BSE-500 from January 1991 to December 2010. The research did not discover the existence of the Indian Stock Market's monthly impact. Nonetheless, the descriptive statistics revealed that May had the highest standard deviation or volatility of any month.
- **Srinivasan and Kalaivani (2014)** thoroughly investigated into the day of the week effect in the Indian stock market. Their analysis revealed favourable outcomes for Monday's stock market returns as well as Wednesday. Compared to Wednesday, Monday's average return was significantly higher.

3. RESEARCH METHODOLOGY

A theoretical and secondary research approach is used in this study. The research design used in this paper is both exploratory and descriptive. It synthesisesknowledge from existing literature, financial theories, and empirical findings pertinent to stock market volatility rather than gathering original data. Data sources include books, working papers, peer-reviewed journals, and reports from various official websites.

4. DISCUSSION

Although the theoretical framework presented in this paper provides a comprehensive perspective for examining stock market volatility in India, a number of more general issues come to light when these concepts are placed within the larger body of research on financial markets and volatility. Numerous local and international factors contributed to volatility in India. The main ones include political motivations, economic policies, governmental regulations, globalisation and privatisation, the overall impact of FIIs, domestic and international civil unrest, psychological factors, etc. The value of Indian stocks is also impacted by changes in global

markets. Because stock markets are fluctuating, investing in them is thought to be risky. Because macroeconomic factors impact the stock market and have an impact on stock prices, there is volatility in the market.

4.1 CAUSES OF VOLATILITY IN INDIAN STOCK MARKET:

1) **Inflation and Interest Rates:** When inflation is high, investors sell their equity holdings because it lowers real corporate earnings. The Reserve Bank of India (RBI) frequently raises policy rates, or repo rates, to combat inflation, which makes borrowing more expensive. This deters investment and decreases market liquidity, which raises volatility.

2) **Speculative Trading and Derivatives:** Overzealous futures and options (F&O) speculation increases volatility in the short term. Derivatives trading frequently experiences sharp price swings during occasions like Union Budget announcements.

3) **Behavioural Biases & Investor Sentiment:** Any new information can trigger a market hive, which raises share prices. Investors may choose to buy the stock over rational valuation in order to stay ahead of the curve. In a similar vein, investor anxiety may cause stock prices to decline as in order to prevent losses, investors scramble to sell off their shares as quickly as possible.

4) **Government Policies:** Before stabilising, reforms like the introduction of the GST, privatisation, and the relaxation of FDI regulations first caused instability. A brief market downturn resulted from the demonetisation decision in 2016. Market sentiment is affected by changes to SEBI regulations, the capital gains tax, or restrictions on foreign investment.

4.2 STEPS TO CONTROL VOLATILITY:

1. **Price Bands and Circuit Breakers**: Individual stocks are subject to price bands (upper and lower limits) in order to reduce excessive speculation and stop panic buying or selling.Typically,circuit breakers have a predetermined percentage value. The circuit breaker is activated when the price of an index or stock moves outside of this predetermined range. Depending on the circumstances, stock market trading is stopped when the circuit breaker is triggered and then resumed after a specific amount of time.

2. **Margin Requirements:**In order to deter excessive speculation, SEBI periodically modifies the margin requirements in the futures and options (F&O) segment. In times of volatility, higher margins guarantee that only serious investors take part.

3. **Pre Trading Session:** Stock market trading in India begins at 9:15 AM and ends at 3:30 PM. However, the market is open from 9:00 AM to 9:15 AM. The purpose of this 15-minute period before the market opens was to stabilise market volatility and unusual movements brought on by significant announcements and events that occur overnight.

4. **Other Measures:** The NSE and BSE's implementation of fast, transparent, and tightly regulated trading platforms reduces technical hiccups and guarantees equitable price discovery. In mutual funds and retirement funds, promoting SIPs (Systematic Investment Plans) lowers short-term speculative trading and improves market stability. By absorbing shocks, a robust bond and derivatives market keeps equity markets from taking the full brunt of volatility.

5. CONCLUSION

The Indian case reveals a more complex reality in which sentiment, institutional features, and international capital flows are equally decisive, in contrast to developed markets where volatility is frequently interpreted primarily as a function of information assimilation.It is necessary to examine India's volatility from both a macro-level (policy, flows) and micro-level (liquidity, trading behaviour) perspective. The efficiency of the stock market is increasing, which may be due to factors like increased retail participation, disclosure regulations, and technological advancements. Investing in various stocks on stock markets is an easy way to reduce risk because it permits investments across multiple entities. By combining their small investments into a larger sum, investors can readily reduce the risk.While maintaining market efficiency, policymakers and market players can lessen needless volatility by enhancing transparency, strengthening liquidity infrastructure, and creating calibrated macroprudential tools. Through the incorporation of a thorough theoretical framework, this paper intends to enhance comprehension of one of the most crucial aspects of India's financial environment. In order to maintain financial stability and equitable economic growth, it will be crucial to manage and interpret volatility as the Indian stock market grows in size, complexity, and global integration.

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IMPROVING THE METHODOLOGY OF REMOTE MONITORING OF THE ECONOMIC SECURITY OF COMMERCIAL BANKS

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ABSTRACT

The purpose of this study is to identify and eliminate the risky or safe, strong or weak aspects of commercial banks in the Republic of Uzbekistan, to assess their resilience to potential risks and shocks, and to detect and prevent the legalization of hidden incomes by applying the coefficients of the CAMELS rating system. The research also aims to find solutions for preventing and mitigating the emergence of banking risks, as well as to regulate and remotely supervise the activities of commercial banks using the tools of the CAMELS rating system. Ultimately, the study evaluates the processes of strengthening the economic security of banks.

KEYWORDS: *Potential Risks And Shocks, Legalization Of Hidden Incomes, Macroprudential Policy Instruments, Economic Security Of Commercial Banks, CAMELS Rating System.*

INTRODUCTION

Conducting research on the regulation of commercial banks' economic security is one of the most pressing issues in contemporary academic inquiry. The effective functioning of the banking sector is vital for a country's economic growth, as it constitutes the central part of the financial system. The banking sector collects idle funds in the form of deposits and redistributes them as loans or advances to support economic development.

However, ensuring the economic security of commercial banks remains one of the most critical modern challenges, given the persistence of unresolved global financial and economic crises. In particular, national and international economists have come to recognize the importance of effectively monitoring and supervising the stability of the banking sector in the aftermath of the global financial and economic crisis of 2007–2008, the pandemic crisis of 2020–2021, and the sharp geopolitical and external economic shifts of 2022. Therefore, in order to regulate the economic security of the country's banking sector and to effectively organize its supervision, it is necessary to introduce the CAMELS rating system [1; pp. 96–116]. Ensuring the stability of commercial banks requires, above all, serious attention to their solvency, liquidity, and profitability, as well as sufficient resilience to emerging risks and shocks, the achievement of competitiveness, and the ability to secure a strong position in the global market. This necessitates a modern evaluation method aimed at ensuring the economic security of banking institutions - the CAMELS rating system.

In international banking practice, the CAMELS rating system plays an important role in regulating and monitoring the economic security of commercial banks. This rating methodology is highly effective for optimal application, providing a valuable tool for regulating and

thoroughly assessing the stability and security of commercial banks. The CAMELS framework comprehensively analyzes and evaluates banks by considering six key components: capital adequacy, asset quality, management soundness, earnings (profitability), liquidity, and sensitivity to market risk. It enables a reliable and comprehensive evaluation of commercial banks' economic security based on data provided remotely by supervisory authorities. When necessary, both quantitative and qualitative assessments, along with expert opinions, can be incorporated into the analysis, and adjustments can be made to the final evaluation results.

LITERATURE REVIEW

The CAMELS rating system has been studied extensively by economists such as J. Baral, Sarkar, Shiu, Nimalathasan, Hermus&Narang, Teker, Dincer, A. Mehta, Prasad &Ravinder, Hofmann, Rozzani& Rahman, Roman, Masood, Shaddady& Moore, and Kulshrestha& Srivastava. For example, J. Baral applied the CAMEL system to assess the condition of joint banks in Nepal and to compare the level of consolidation of joint banks with that of commercial banks. However, his findings revealed that the CAMEL parameters were relatively weak in terms of financial consolidation, particularly under conditions of wide-ranging shocks [2; pp. 12–31].

Prasad & Ravinder employed the CAMEL framework to evaluate the performance of 20 national banks in India [3; pp. 23–37]. Similarly, Shaddady& Moore used the CAMEL system to analyze the effects of regulatory measures on bank stability, covering 2,210 bank observations across European countries during the period 2000–2016. Kulshrestha& Srivastava, in their comparative study, analyzed the financial performance of public and private sector banks using the CAMEL methodology [4; pp. 67–87]. Their research developed a rating approach based on average indicator ratios and conducted statistical tests to determine significant differences. The results demonstrated that private sector banks outperformed public sector banks in terms of financial performance.

METHODOLOGY

The economic security of the banking sector in the context of artificial intelligence technologiesIt would be appropriate to identify a number of tasks to be carried out in the future to analyze and evaluate the threats based on the CAMELS rating system, and to systematically assess safe activities. For this, in finding a solution to the problematic issue posed to perform experimental calculationsfunctionalIt is necessary to develop hardware, software, information support and other organizational and methodological measures. This is precisely the economic security of the banking sector.When analyzing and mathematically describing the processes of assessing threats, it is necessary to take into account the quantitative and qualitative indicators that represent them. Therefore, we have developed computational models and algorithms for analyzing the economic security of a bank in accordance with the conditions for mathematically describing the economic security of the banking sector in the following order:

I. Capital Congruence (C) algorithms:

1. Regulatory capital (C_{rk}) is the amount of risk-weighted assets(C_{ra}) is equal to the ratio

$C_1 = C_{rk} / C_{ra}$

2. Regulatory capital (C_{rk}) is the ratio of total assets(C_{ua}) is equal to the ratio

$C_2 = C_{rk} / C_{ua}$

3. between capital and fixed assets ($C_{rk} – C_{ov}$) is equal to the ratio of total assets (C_{ua})

$C_3 = (C_{rk} – C_{av}) / C_{um}$

4. Total liabilities (C_{um}) are equal to the ratio of total assets (C_{ua})

$C_4 = C_{rk} / C_{um}$

5. Government securities (C_{qq}) are equal to the ratio of total investments (C_{ui})

$C_5 = C_{qq} / C_{ui}$

II. Asset Quality (A) algorithms:

6. Earnings-generating assets (A_{dk}) are equal to the ratio of total assets (C_{ua})

$A_1 = A_{dk} / C_{ua}$

7. Total investments (A_{uk}) of total assets (C_{ua}) is equal to the ratio

$A_2 = A_{ui} / C_{ua}$

8. Non - performing loans (NPL) are a percentage of total loans and advances.(A_{uk}) is equal to the ratio

$A_3 = A_{kd} / A_{uk}$

9. Provisions for potential loan losses (A_{kz}) are the percentage of total loans and advances.(A_{uk}) is equal to the ratio

$A_4 = A_{kz} / A_{uk}$

10. Total loans and borrowings (A_{uk}) of total assets(C_{ua}) is equal to the ratio

$A_5 = A_{yk} / C_{ua.}$

III. Management Quality (M) algorithms:

11. Profit per employee (M_{bx}) (M_{sf})

$M_1 = M_{sf} / M_{bx}$

12. Business share peremployee (M_{bz})

$M_2 = M_{sf} / M_{bz}$

13. Debt to total assets(C_{ua}) is equal to the ratio

$M_3 = M_{qm} / C_{ua}$

14. Revenues are equal to the ratio of expenses

$M_4 = M_{dd} / M_{xt}$

15. Total loans and advances (A_{uk}) of total depositsequal to the ratio

$M_5 = A_{uk} / M_{jd}$

IV. D aromad (profitability) algorithms (E):

16. Net profit (loss) (E_{sf}) is equal to the ratio of return on assets (E_{ar})

$E_1 = E_{sf} / E_{ar}$

17. Net profit (loss) (E_{sf}) is equal to the ratio of return on equity (E_{ar})

$E_2 = E_{of} / E_{cr}$

18. Operating profit (E_{of}) is equal to the ratio of return on assets (E_{ar})

$E_3 = E_{of} / E_{ar}$

19. Interest income (E_{fd}) is equal to the ratio of return on assets (E_{ar})

$E_4 = E_{fd} / E_{ar}$

20. Interest-free income (E_{df}) is equal to the ratio of return on assets (E_{ar})

$E_5 = E_{df} / E_{ar}$

V. Liquidity (L) algorithms:

21. Liquid assets (L_{av}) as a percentage of total assets (C_{ua})equal to the ratio

$L_1 = L_{av} / C_{ua}$

22. Liquid assets (L_{av}) are equal to the ratio of short-term liabilities (L_{qm})

$L_2 = L_{av} / L_{qm}$

23. Liquid assets (L_{av}) are equal to the ratio of total deposits (M_{jd})

$L_3 = L_{av} / M_{jd}$

24. Government securities (C_{qq}) are equal to the ratio of total assets (C_{ua})

$L_4 = C_{qq} / C_{ua}$

VI. Market risk sensitivity (S) algorithms:

25. Bank assets (S_{ba}) are equal to the ratio of total banking sector assets (S_{ua})

$S_1 = S_{ba} / S_{sa}$

Therefore, it is possible to use models and algorithms built according to the rules of the bank's economic security analysis processes for a specific period (month, quarter, year). Their typical terms summarize and systematize economic indicators, taking into account both quantitative and qualitative aspects, in proportion to the planning period.

Analysis of the economic security and financial condition of the bank can provide an opportunity to analyze financial indicators and formulate their strategic directions according to the developed scenarios.

Although the CAMELS rating system is used in the supervision of US commercial banks, this system determines the impact of each component on bank management in order to determine the rating, indicates the final assessment level and, in turn, predetermines the attitude of supervisory authorities towards the bank.

Now let's discuss the components of the CAMELS rating system.

Capital adequacy. The capital adequacy component (C–capital adequacy) is one of the main

components of the CAMELS rating system . This component serves to protect the potential interests of depositors and creditors, determine the adequacy of the amount of capital, and determine the level of stability and efficiency of the country's financial system. Bank capital consists of the sum of core capital (Tier I capital) and additional capital (Tier II capital).

The capital adequacy ratio is defined as the ratio of total capital to risk-weighted assets. The higher this ratio, the higher the economic security and financial stability of the bank, or vice versa. The higher the capital adequacy ratio, the more conservatively the bank uses its own capital . According to the recommendations of the Basel Committee, the capital adequacy ratio requirements should not be less than 10%. Ensuring this ratio is very important for maintaining the trust of stakeholders, protecting against bankruptcy and ensuring the economic security of the bank.

Table 1

PARAMETERS OF THE CAPITAL ADEQUACY RATIO OF COMMERCIAL BANKS IN UZBEKISTAN IN 2018 - 2024

Bank name	C_{rk} / C_{ra}: C_{rk} / C_{ua} : (C_{rk} –C_{ov})/C_{ua} :C_{um} / C_{ua} : C_{qq} /C_{ui}: Group Rank											
	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank
Agrobank	20.69	7	12.83	6	7.83	7	81.67	9	83.74	8	34.63	6
Aloqabank	18.39	10	10.21	9	6.43	9	79.86	9	79.21	9	32.52	9
Asakabank	25.01	2	14.91	3	10.67	2	90.83	2	88.97	3	38.57	2
Mikrokreditbank	20.78	7	10.34	8	7.11	7	82.26	9	81.00	8	33.75	7
O‘zmilliybank	26.12	1	15.54	1	9.01	4	93.60	1	93.21	3	39.75	1
Ipotekabank	20.11	8	10.98	8	6.89	8	78.54	10	79.73	9	32.88	8
Xalqbanki	24.11	4	14.34	3	10.93	2	92.57	3	83.71	1	37.57	3
IpakYo‘libanki	18.97	10	9.03	11	5.67	10	78.47	10	76.33	10	31.58	10
Qishloqqurilish bank	21.07	5	12.86	6	8.11	6	88.86	8	81.37	8	35.88	5
Ravnaqbank	16.51	11	9.27	11	4.07	11	72.51	11	69.81	11	28.81	11
O‘zsanoatqurilishbank	23.76	4	12.89	5	7.79	6	91.21	4	84.31	7	36.83	4
EronSoderotbank	15.86	12	8.77	12	3.47	12	71.21	12	68.32	12	27.77	12

Asset quality. The asset quality (A–asset quality) component assesses the level of return on assets from customers and the degree of impact of problem debts on financial resources. Risky assets are usually divided into groups such as special assets, non-standard assets, doubtful assets and bad assets. Here, special assets are classified by the amount of 0%, non-standard assets - 20%, doubtful assets - 50% and bad assets - 100%.

Table 2

PARAMETERS OF THE ASSET QUALITY RATIO OF COMMERCIAL BANKS IN UZBEKISTAN IN 2018 - 2024

Bank name	A_{dk} / C_{ua}		A_{ui} / C_{ua}		A_{kd} / A_{uk}		A_{kz} / A_{uk}		A_{uk} / C_{ua}		Group Rank	
	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank
Agrobank	90.57	7	16.74	6	2.01	7	1.42	6	70.91	6	30.44	6
Aloqabank	87.72	10	13.32	9	1.97	9	1.32	9	69.91	9	29.21	9
Asakabank	95.91	2	19.03	2	3.49	3	1.50	3	71.19	1	32.02	2
Mikrokreditbank	90.11	7	15.56	7	2.34	7	1.38	7	69.79	8	30.03	7
O‘zmilliybank	96.23	1	19.83	2	3.81	1	1.52	2	71.27	1	32.28	1
Ipotekabank	89.46	8	14.21	8	2.04	8	1.35	10	70.04	9	29.68	8
Xalqbanki	94.32	3	19.01	3	3.49	3	1.47	4	71.15	3	31.74	3
IpakYo‘libanki	87.37	10	12.17	11	1.52	10	1.28	10	69.56	10	28.82	10
Qishloqqurilish bank	92.28	5	16.89	6	2.28	6	1.45	5	70.98	5	30.81	5
Ravnaqbank	86.97	11	12.21	11	1.42	11	1.25	11	67.31	12	28.36	11
O‘zsanoatqurilishbank	93.17	5	18.91	5	3.01	4	1.47	4	71.01	4	31.27	4
EronSoderotbank	86.37	11	11.08	12	1.39	12	1.21	12	67.32	12	28.06	12

Quality of governance. The governance component assesses the quality of bank management based on the results of monitoring and control systems in accordance with laws and regulations. Proper and effective governance is the key to the operation of any entity.

The CAMELS rating system analyzes the level of quality of bank management (M-management). This component determines the quality of bank management based on the assessment of the laws, regulations and results of banking activities adopted in the supervisory system and, in turn, assesses the reliability of the bank. This indicator depends on the results of the previous indicators, since banks with capital adequacy, asset quality, profitability and stability have a high level of quality management. This situation is analyzed by the level of knowledge of employees; compliance with regulatory and legal documents; the perfection of personnel policy, credit policy, investment policy, interest rate policy and banking policy, and, in turn, their correct selection.

After evaluating each of the CAMELS rating system components separately, the final rating of the bank is determined. In most cases, the rating is carried out using assessment coefficients. In such cases, the impact on the final rating is either increased or decreased. The final rating provides information to the inspectors about whether the bank is “good”, “satisfactory”, “adequate” or “unsatisfactory”.

Table 3

PARAMETERS OF THE GOVERNANCE QUALITY COEFFICIENT OF COMMERCIAL BANKS IN UZBEKISTAN IN 2018 - 2024

M_{sf} / M_{bx}	M_{sf} / M_{bz}	M_{qm} / C_{ua}	M_{dd} / M_{xt}	A_{uk} / M_{jd}	Gr. Rank

Bank name	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank
Agrobank	2.68	6	86.74	6	45.76	8	5.02	6	88.31	6	38.25	6
Aloqabank	1.96	9	63.32	9	44.79	9	3.84	9	81.52	10	32.74	9
Asakabank	3.68	2	129.23	2	53.71	3	6.51	2	92.59	2	47.79	2
Mikrokreditbank	2.39	7	69.56	8	46.87	7	4.78	7	87.79	8	35.40	7
O‘zmilliybank	3.96	1	129.01	2	56.81	1	6.93	1	93.67	1	48.56	1
Ipotekabank	2.23	8	69.21	8	45.74	8	4.29	10	81.94	9	34.05	8
Xalqbanki	3.39	3	105.11	4	53.67	3	6.17	4	91.16	3	43.42	3
IpakYo‘libanki	1.59	10	57.17	11	43.52	10	3.28	10	77.56	10	30.69	10
Qishloqqurilish bank	2.99	5	94.34	6	46.89	7	5.68	5	89.21	5	40.02	5
Ravnaqbank	1.27	11	39.21	11	36.19	12	2.15	11	76.85	12	26.11	11
O‘zsanoatqurilishbank	3.02	4	94.97	5	51.83	4	5.86	4	90.67	4	41.23	4
EronSoderotbank	1.28	11	36.78	12	36.18	12	1.33	12	75.70	12	25.37	12

Profitability. The earnings component (E–earnings) assesses the efficiency of the bank's activities, which determines the possibility of obtaining sufficient profit in the future. The use of data for three years is associated with the phase of the earnings cycle. In this case, the profitability criterion can be highly stable, and the level of cyclical fluctuations can be low.

Table 4

PARAMETERS OF THE INCOME (PROFITABILITY) RATIO OF COMMERCIAL BANKS IN UZBEKISTAN IN 2018 - 2024

Bank name	E_{sf} / E_{ar}: Ave	Rank	E_{of} / E_{kr}: Ave	Rank	E_{of} / E_{ar}: Ave	Rank	E_{fd} / E_{ar}: Ave	Rank	Group Rank Ave	Rank	Ave	Rank
Agrobank	1.49	6	15.67	2	3.69	6	2.84	6	2.25	10	4.49	6
Aloqabank	1.12	9	13.99	9	3.57	9	3.14	9	2.75	7	4.26	9
Asakabank	1.71	1	19.47	2	6.11	2	3.81	2	3.56	2	5.94	2
Mikrokreditbank	1.38	7	13.17	10	4.17	8	3.58	7	2.75	7	4.34	7
O‘zmilliybank	1.71	1	19.47	2	6.31	1	4.13	1	3.76	1	6.06	1
Ipotekabank	1.24	8	14.11	8	3.69	9	3.29	10	2.71	8	4.32	8
Xalqbanki	1.54	3	15.67	3	5.83	3	3.36	4	3.36	3	5.13	3
IpakYo‘libanki	1.09	10	13.17	10	3.52	10	2.28	10	2.25	11	3.89	10
Qishloqqurilish bank	1.29	5	14.93	5	5.13	5	2.72	6	3.07	5	4.72	5
Ravnaqbank	0.98	11	9.21	11	3.52	10	1.81	11	1.25	11	2.96	11
O‘zsanoatqurilishbank	1.42	4	14.93	5	5.56	4	3.36	4	3.27	4	4.92	4
EronSoderotbank	1.09	10	9.03	12	1.51	12	1.34	12	1.14	12	2.52	12

Liquidity. The liquidity component (L-liquidity) determines the degree to which a bank is sufficiently liquid in terms of timely fulfillment of obligations. Bank liquidity assesses the readiness of a bank to timely meet the credit requirements of its customers. The analysis of this component, like the income component, determines the content, volume and scale of bank operations, which differ from other banks. There is currently no single formula for assessing the liquidity of banks.

The liquidity of an individual bank is assessed taking into account the level of dependence on non-permanent deposits, credit resources, the degree of sensitivity to changes in interest rates, liquid assets in the form of cash , access to the money market, the efficiency of asset and liability management, and the purpose and amount of the estimated use of future obligations.

Table 5

LIQUIDITY RATIO PARAMETERS OF COMMERCIAL BANKS IN UZBEKISTAN IN 2018 - 2024

Bank name	L_{av} / C_{ua} :		L_{av} / L_{qm} :		L_{av} / L_{dt}:C_{qq} / C_{ua} :		Group Rank	
	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank	Ave	Rank
Agrobank	27.31	6	1.43	6	35.78	5	17.27	6	16.56	6
Aloqabank	26.16	8	1.31	9	33.79	9	12.74	9	15.00	9
Asakabank	29.43	2	1.51	3	36.12	2	19.01	2	17.42	2
Mikrokreditbank	26.38	7	1.39	7	34.92	7	17.27	6	16.19	7
O‘zmilliybank	30.76	1	1.53	2	36.87	1	19.76	1	17.98	1
Ipotekabank	26.16	8	1.39	8	34.37	8	12.74	9	15.13	8
Xalqbanki	29.43	2	1.51	3	35.84	3	18.88	3	17.33	3
IpakYo‘libanki	24.93	10	1.17	10	33.79	9	14.35	11	15.05	10
Qishloqqurilish bank	27.96	5	1.48	4	35.78	5	15.89	5	16.25	5
Ravnaqbank	23.98	11	1.08	11	30.52	10	10.25	11	13.37	11
O‘zsanoatqurilishbank	28.37	4	1.51	3	35.43	4	18.27	4	16.92	4
EronSoderotbank	24.93	10	1.02	12	30.04	12	9.11	12	13.22	12

Market risk. The sensitivity to market risk (S – sensitivity to market risk) component of the CAMELS rating system serves to assess market risks. Market risk includes interest rate risk, currency risk and fund risk. In this case, interest rate risk affects the value of financial instruments in the securities market and changes in interest rates, as well as profit, as well as bank capital. Currency risk, in turn, affects bank profits, bank capital and exchange rate changes. Fund risk, in turn, affects the level of change in the value of the securities market with funds in the bank's trading portfolio, bank profits and bank capital.

Market risk assessment determines the impact of bank profits on bank capital, changes in interest rate levels, non-trading positions in banks, reserves to cover potential losses on trading operations and securities-related operations. The market risk management system serves to assess, control and regulate the solvency of banks.

Table 6

PARAMETERS OF THE MARKET RISK SENSITIVITY COEFFICIENT OF COMMERCIAL BANKS IN UZBEKISTAN IN 2018 - 2024

Bank name	S_{ba} / S_{sa}		Group Rank	
	Ave	Rank	Ave	Rank
Agrobank	11.97	6	11.97	6

Aloqabank	8.98	9				8.98	9		
sakabank	15.78	2				15.78	2		
Mikrokreditbank	10.47	7				10.47	7		
O‘zmilliybank	16.19	1				16.19	1		
Ipotekabank	9.89	8				9.89	8		
Xalqbanki	14.86	3				14.86	3		
IpakYo‘libanki	7.53	10				7.53	10		
Qishloqqurilish bank	12.89	5				12.89	5		
Ravnaqbank	5.87	11				5.87	11		
O‘zsanoatqurilishbank	13.61	4				13.64	4		
Eron Soderot bank	4.39	12				4.39	12		

The current rating for banks based on the CAMELS rating system is calculated based on an assessment of the state of key indicators. The risk category is reviewed quarterly along with the current rating, resulting in changes to the composition of the main component. The final rating calculated according to the CAMELS system is taken into account in the final assessments.

After each of the CAMELS rating system components is evaluated separately, the final rating of the bank is determined. In most cases, the rating is carried out using rating coefficients . In this case, the influence of the final rating is either increased or decreased. The final rating provides managers with information about whether the bank is “good”, “satisfactory”, “adequate” or “unsatisfactory”.

Table 7

GENERAL PARAMETERS OF COMMERCIAL BANKS IN UZBEKISTAN ACCORDING TO THE CAMELS RATING SYSTEM IN 2018 - 2024

Bank name	**C**	**A**	**M**	**E**	**L**	**S**	AVG	Rating
Agrobank	34.63	30.44	38.25	4.49	16.56	11.97	19.62	6
Aloqabank	32.52	29.21	32.74	4.26	15.00	8.98	17.67	9
Asakabank	38.57	32.02	47.79	5.94	17.42	15.78	22.65	2
Mikrokreditbank	33.75	30.03	35.40	4.34	16.19	10.47	18.74	7
O‘zmilliybank	39.75	32.28	48.56	6.06	17.98	16.19	23.11	1
Ipotekabank	32.88	29.68	34.05	4.32	15.13	9.89	18.14	8
Xalqbanki	37.57	31.74	43.42	5.13	17.33	14.86	21.58	3
IpakYo‘libanki	31.58	28.82	30.69	3.89	15.05	7.53	16.94	10
Qishloqqurilish bank	35.88	30.81	40.02	4.72	16.25	12.89	20.22	5
Ravnaqbank	28.81	28.36	26.11	2.96	13.37	5.87	15.21	11
O‘zsanoatqurilishbank	36.83	31.27	41.23	4.92	16.92	13.61	20.83	4
Eron Soderot bank	27.77	28.06	26.37	2.52	13.22	4.39	14.62	12

The diagram below shows the level of economic security of commercial banks, calculated as an average, using the data in Table 7.

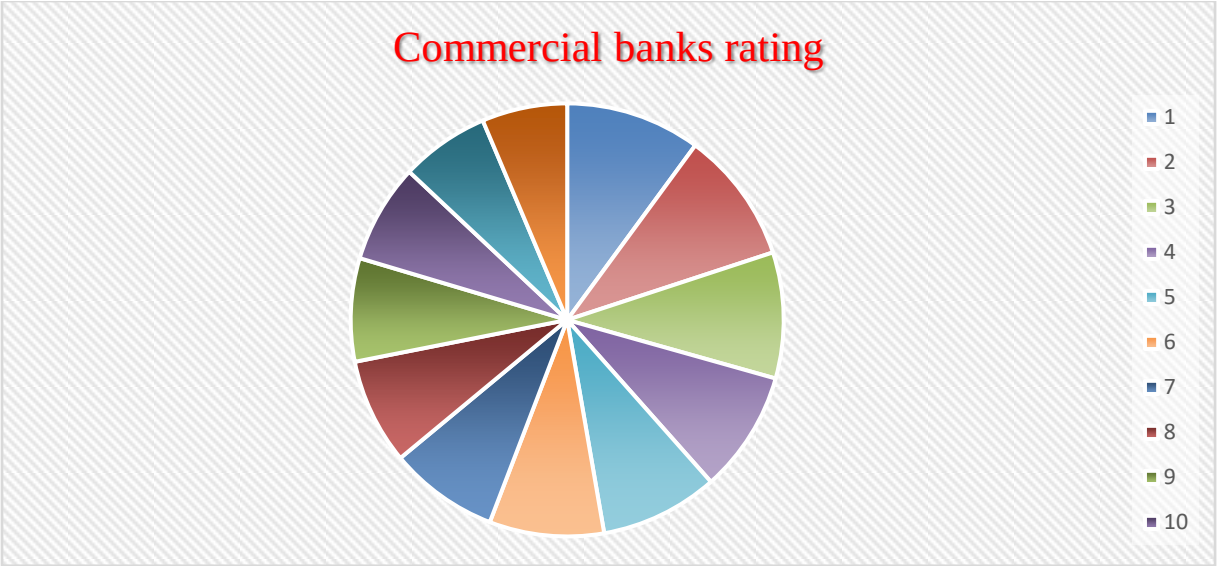


Fig.1. Diagram of ensuring the economic security of commercial banks, based on the average amount

Functional for performing experimental calculations on a computer to solve the given problemdevelop hardware, software, information support, and other organizational and methodological measures.

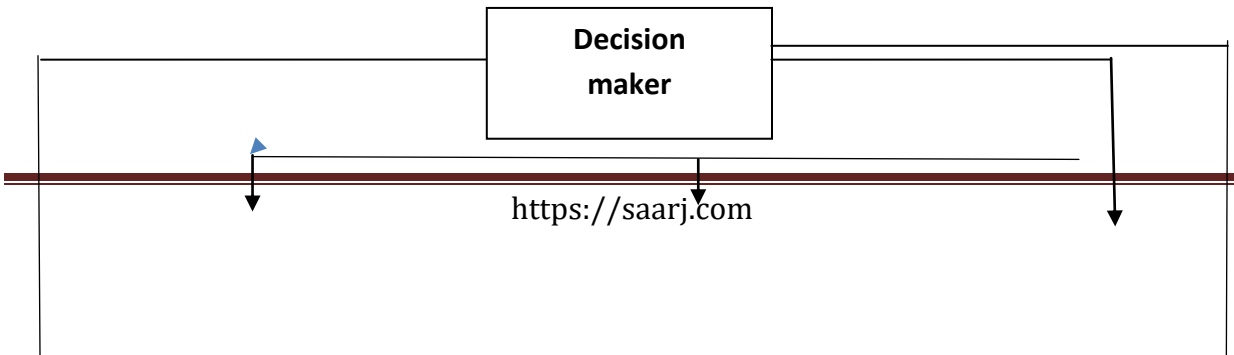
Is based on models and algorithms related to ensuring solvency, taking into account the conditions and characteristics of the enterprise's activities. Its modelsand the connection between algorithms is ensured through a single database. The single database forms the basis of information support. In information processing, the information source is The data to be entered and printed is divided into separate groups.separated. Data setcommercial banksfinancial statements,accounting,it consists of standards and other similar types of information.

Through data entered into computer memoryensuring the economic security of each bankthe optimal value of the indicators for ensuring the economic security of each bank is formed by making changes to the initial parameters within the accepted limits.

The results obtained Depending on the level of availability , the experimenter decides whether to continue or terminate the study. Therefore, based on the principle of systematic information and logical connections of the problematic issue we posed, we developed a scheme for assessing the degree of solvency of enterprises using software (Fig.2).

In the study, we created solution parameters for the problem posed by implementing algorithms and models for assessing the level of economic security of commercial banks and finding solutions for rapid forecasting.

Assessing the economic security of commercial banks are balanced, managers at different levels will comparatively evaluate the results of decisions made on alternative options.



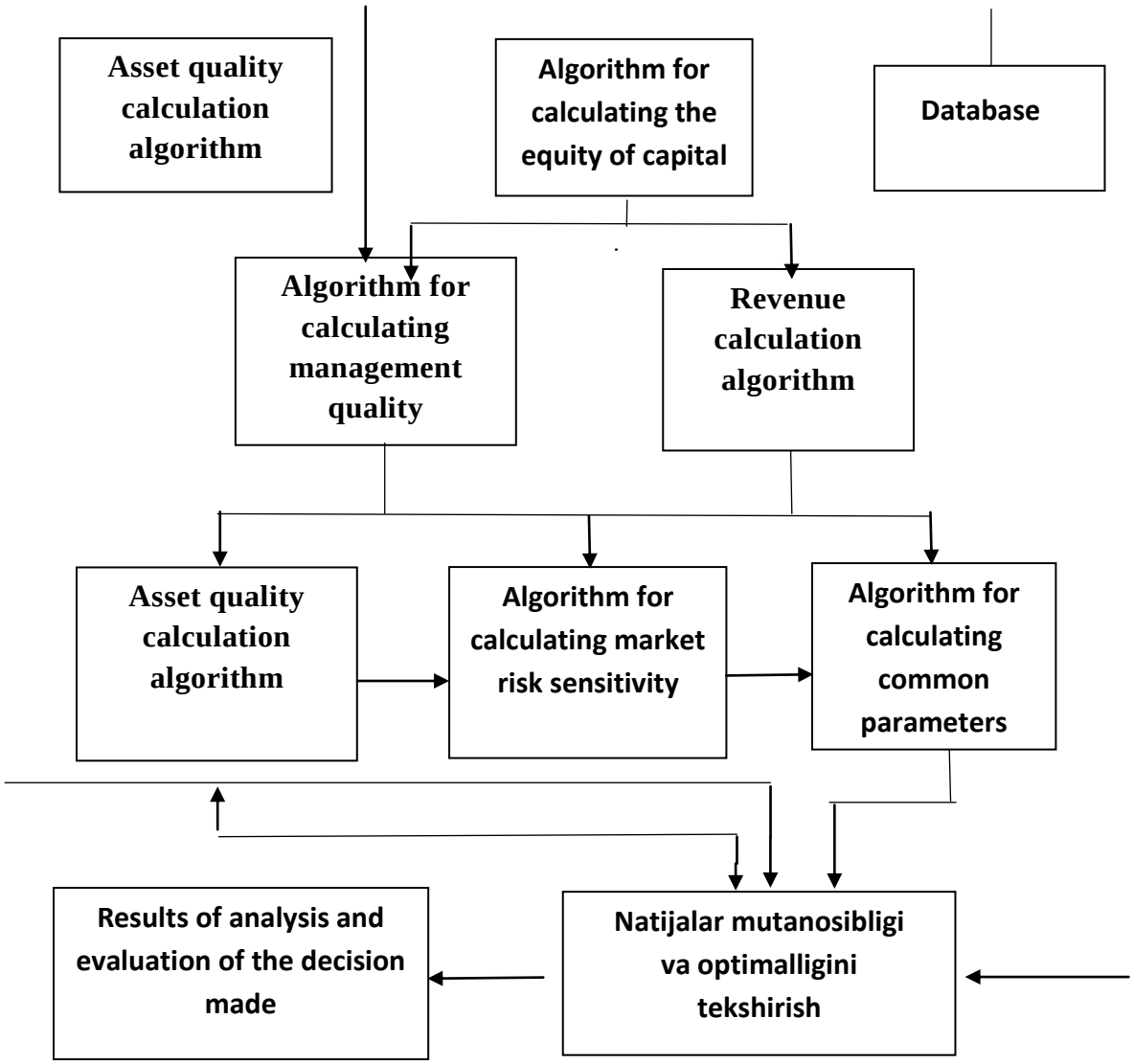


Fig. 2. Mechanism for assessing the economic security of commercial banks based on the CAMELS rating system

If the results of any of the generated alternative scenarios do not satisfy the experimenter, managers at different levels return to the database and re-implement the algorithms and models using new quantitatively large amounts of data. The iterative procedure continues until the results of the assessment of the economic security of commercial banks are found for each scenario.

The database provides for the possibility of using information with systematic consideration of the economic conditions of the bank.

CONCLUSION

The CAMELS rating system helps users to assess not only the current state of economic security of commercial banks, but also their economic security , early detection of economic threats and risks, assessment of their prevention and elimination, and increase the efficiency of making operational management decisions. For example, table 7 shows the general economic indicators of 12 commercial banks selected for analysis by the CAMELS rating system. Among the banks, the National Bank of Uzbekistan and Asakabank achieved high- level indicators and took first and second places with an average score of 23.11 and 22.65 points, respectively. However, Ravnaqbank and Iran Soderot Bank achieved the lowest-level indicators and took the average score ofThey ranked eleventh and twelfth with scores of 15.21 and 14.62, respectively. This situation shows the weakness of Ravnaqbank and Iran Soderot Bank, which are exposed to internal and external threats,it shows that it is unable to adequately withstand risks and shocks, and that customer trust is waning.

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TRENDS AND CHALLENGES IN PEARL MILLET PRODUCTION WITH SPECIAL REFERENCE TO EASTERN UTTAR PRADESH

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ABSTRACT

Millet, a resilient grain, has been a staple crop for centuries. In 2023, the UN declared the International Year of Millets to highlight its role in addressing food security, nutrition, and sustainable agriculture. This study analyzes trends in pearl millet production in Eastern Uttar Pradesh from 2017-18 to 2021-22, focusing on area, yield, and interaction effects across 20 districts.

***Purpose**: To assess production trends, identify spatial challenges, and recommend strategies for enhancing millet cultivation.*

***Design/Methodology/Approach**: Secondary data on area, yield, and production are analyzed using CAGR and decomposition analysis to evaluate growth and the contributions of area and yield changes.*

***Findings**: Significant variations in production trends are observed, with area and yield changes impacting output differently. Interaction effects highlight the need for targeted interventions.**Originality/Value**: This study offers valuable agricultural planning and policy insights, supporting efforts to promote millet cultivation for sustainable development and food security.*

KEYWORDS: *Pearl millet, Production trends, Sustainable agriculture, Food security, Climate Change.*
JEL Classification- Q10,Q12,Q13,Q18,Q56,R11,O13.

1.INTRODUCTION

Eastern Uttar Pradesh has been selected for studying millet production due to its strategic location in the Indo-Gangetic Plain, representing 35.63% of the state's land area and serving as a significant agricultural zone (**Shakeel,2013**). The region has a diverse cropping history but is transitioning from traditional coarse cereals to fine cereals and cash crops, driven by economic and market demands (**Shakeel,2013**). This shift underscores the importance of analyzing how evolving agricultural practices impact millet cultivation, an integral part of the region's

agricultural heritage and diet. Understanding these dynamics is critical for assessing food security and sustainability in the area, particularly declining millet production.

Pearl millet's drought resistance makes it highly relevant to this study, as the crop excels in arid conditions where water scarcity and poor soil challenge other crops. Its ability to conserve water by folding or withering leaves during drought, especially at critical growth stages like grain filling, ensures its survival and productivity (**Redmann, 1985; Kadioglu and Terzi, 2007**). This unique adaptation is vital for maintaining food security in regions like Eastern Uttar Pradesh, where agricultural practices are changing. The research aims to contribute valuable insights into agricultural resilience and sustainability by studying pearl millet's role in this evolving landscape.

2.REVIEW OF LITERATURE

Jukanti et al. (2016) highlighted pearl millet's resilience to drought, high temperatures, and poor soil, making it ideal for arid regions. Its rich nutritional profile, including energy, fiber, proteins, essential minerals, vitamins, and antioxidants, helps prevent diseases like diabetes and cardiovascular conditions. Despite its genetic variability and pest resistance, its potential remains underutilized due to limited genetic improvements and poor crop management. **Erler, Keck, and Dittrich (2020)** observed a shift in Bengaluru, where millets transitioned from traditional staples tolifestyle superfoods,driven by marketing and health-conscious consumers, reflecting class-based distinctions. **Satyavathi et al. (2021)** emphasized pearl millet's climate resilience and nutritional value, highlighting advancements in hybrid development, stress tolerance, and genomic technologies alongside supportive policies like India's micronutrient standards. **Chaudhary et al. (2023)** examined declining millet trends in India from 1950–2021, identifying yield improvements as drivers for bajra and ragi, while area expansion influenced jowar and small millets. Despite these trends, consumption declined, prompting calls for awareness, training, and policy support. **Deevi et al. (2024)** stressed pearl millet's global importance, noting its role as a gluten-free staple primarily in Africa and Asia, though cultivation areas declined from 35 to 32 million hectares (2007–2019). Rising Asian yields and growing global demand by 2050 suggest opportunities for expanded production, though challenges like yield instability and socio-economic constraints persist.

3.Objectives

1. To analyze the spatial challenges in pearl millet performance across districts in the Eastern Region of Uttar Pradesh.
2. To evaluate trends in pearl millet production across the eastern region of Uttar Pradesh.

4.RESEARCH METHODOLOGY

This study utilized secondary data to analyze the trends in pearl millet production in Eastern Uttar Pradesh. The data on area, production, and productivity were compiled from the Directorate of Economics and Statistics, Uttar Pradesh. The dataset covers the period from 2017-18 to 2021-22. This period was selected to provide a comprehensive overview of the trends and changes in pearl millet production over time. The data includes the area under cultivation, total production, and productivity.

The CAGR formula measures the annual growth rate of pearl millet production from 2017-18 to 2021-22.

Compound Annual Growth Rate

$CAGR = [Ending\ Value / Beginning\ Value]^{(1/n)} - 1$

Where:

- **The ending Value** is the Value at the end of the period.
- **The beginning Value** is the Value at the start of the period.
- **n** is the number of years.

Decomposition of Growth Components:

Decomposition analysis is used to understand the contributions of various factors, such as area, yield, and their interactions, to changes in pearl millet production between 2017–18 and 2021–22.

Overall change in Production (ΔP) = Area effect+ yield effect+ interaction effect

Yield effect

yield effect = $^{Ao \times \Delta Y}$

where Ao= Area in the base year

$\Delta Y = Y_n - Y_o$ (change in yield between the base year and nth year)

Area Effect

Area Effect = $Y_o \times \Delta A$

where Y_o=yield in the base year

$\Delta A = A_n - A_o$ (Change in Area between the base year and nth year)

Interaction Effect

Interaction Effect= $\Delta A \times \Delta Y$

Where: ΔA (Change in Area) = $A_n - A_o$ and ΔY (change in yield) = $Y_n - Y_o$

thus, the Total change in Production (ΔP) can be expressed as:

$\Delta P = A_o \times \Delta Y + Y_o \times \Delta A + \Delta A \times \Delta Y$

5.DATA ANALYSIS

The study analyzed district-wise data on the area, production, and productivity of pearl millet in Eastern Uttar Pradesh from **2017–18** to **2021–22.** Decomposition analysis was employed to calculate the area, yield, and interaction effects and determine their contribution to changes in production over the study period.

Additionally, the Compound Annual Growth Rate (CAGR) was calculated to assess the overall growth trends in pearl millet production. The decomposition and CAGR calculations were performed using standard statistical formulas, ensuring accurate attribution of the effects. The results are summarized in the table below for better understanding and interpretation.

Table 1. District-wise Area, production, and productivity of pearl millets in Eastern Uttar Pradesh

TABLE 1. DISTRICT-WISE AREA, PRODUCTION, AND PRODUCTIVITY OF PEARL MILLETS IN EASTERN UTTAR PRADESH

S. N.	Division	DISTRICTS	YEARS														
			2017-18			2018-19			2019-20			2020-21			2021-22		
			Total Area ('000 hectares)	Production(tonnes)	Productivity (q/ha)	Total Area ('000 hectares)	Production(tonnes)	Productivity(q/ha)	Total Area ('000 hectares)	Production(tonnes)	Productivity(q/ha)	Total Area ('000 hectares)	Production(tonnes)	Productivity (q/ha)	Total Area ('000 hectares)	Production(tonnes)	Productivity (q/ha)
1	AZAMGARH DIV.	AZAMGARH	112.00	216.00	19.29	105.00	218.00	20.76	112.00	242.00	21.61	118.00	283.00	23.98	115.00	251.00	21.83
2		BALLIA	1981.00	3825.00	19.31	1802.00	3749.00	20.80	460.00	993.00	21.59	1894.00	4610.00	24.34	1879.00	4079.00	21.71
3		MAU	48.00	93.00	19.38	22.00	46.00	20.91	48.00	104.00	21.67	42.00	106.00	25.24	47.00	100.00	21.28
4	DEVI PATAN DIV.	BAHRAICH	14.00	27.00	19.29	30.00	61.00	20.33	30.00	64.00	21.33	2.00	4.00	20.00	20.00	45.00	22.50
5		BALRAMPUR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6		GONDA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7		SHRAVASTI	10.00	19.00	19.00	0.00	0.00	0.00	2.00	4.00	20.00	7.00	17.00	24.29	0.00	0.00	0.00
8	FAIZABAD DIV.	AMBEDKAR NAGAR	8.00	16.00	20.00	9.00	19.00	21.11	9.00	19.00	21.11	2.00	5.00	25.00	3.00	7.00	23.33
9		AMETHI	458.00	904.00	19.74	385.00	796.00	20.68	426.00	921.00	21.62	396.00	946.00	23.89	412.00	901.00	21.87
10		BARABANKI	552.00	1089.00	19.73	641.00	1326.00	20.69	443.00	957.00	21.60	545.00	1289.00	23.65	573.00	1256.00	21.92
11		FAIZABAD	2.00	4.00	20.00	67.00	139.00	20.75	1.00	2.00	20.00	2.00	4.00	20.00	1.00	3.00	30.00
12		SULTANPUR	134.00	264.00	19.70	203.00	420.00	20.69	214.00	463.00	21.64	163.00	394.00	24.17	157.00	342.00	21.78
13	GORAKHPUR DIV.	DEORIA	148.00	286.00	19.32	186.00	412.00	22.15	139.00	305.00	21.94	155.00	372.00	24.00	148.00	322.00	21.76
14		GORAKHPUR	9.00	17.00	18.89	7.00	15.00	21.43	8.00	17.00	21.25	7.00	17.00	24.29	8.00	18.00	22.50
15		KUSHINAGAR	103.00	199.00	19.32	335.00	742.00	22.15	181.00	397.00	21.93	147.00	360.00	24.49	103.00	220.00	21.36
16		MAHRAJGANJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	VARANASI DIV.	CHANDAULI	4150.00	4770.00	11.49	4930.00	5636.00	11.43	4889.00	4394.00	8.99	4974.00	6930.00	13.93	4903.00	4410.00	8.99
18		GHAZIPUR	14763.00	15480.00	10.49	15845.00	28360.00	17.90	14566.00	19525.00	13.40	15140.00	24054.00	15.89	15161.00	10373.00	6.84
19		JAUNPUR	4937.00	5797.00	11.74	5957.00	7509.00	12.61	7093.00	11039.00	15.56	5997.00	9258.00	15.44	5922.00	7391.00	12.48
20		VARANASI	6195.00	5888.00	9.50	4916.00	8718.00	17.73	5544.00	8111.00	14.63	4784.00	5104.00	10.67	5504.00	10130.00	18.40

(**Source:** Directorate of Economics and Statistics Uttar Pradesh)

Table 2. Calculation of Area Effect, Yield Effect, and Interaction Effect from 2017-18 to 2021-22 (in Quintals)

TABLE 2. CALCULATION OF AREA EFFECT, YIELD EFFECT, AND INTERACTION EFFECT FROM 2017-18 TO 2021-22 (IN QUINTALS)

DIVISION	DISTRICTS	YEILD EFFECT				AREA EFFECT					INT. EFF.
		Base year area(A0)	yield of base year(Y0)	Change in yield (▲Y)	A0×▲Y	yield of base year(Y0)	Base year area(A0)	area of current year (A nth year)	Change in area ▲A	Y0×▲A	▲A×▲Y
AZAMGARH DIVISION	AZAMGARH	112.00	19.29	2.54	284.52	19.29	112.00	115.00	3.00	57.86	7.62
	BALLIA	1981.00	19.31	2.40	4754.25	19.31	1981.00	1879.00	-102.00	-1969.46	-244.79
	MAU	48.00	19.38	1.90	91.28	19.38	48.00	47.00	-1.00	-19.38	-1.90
DEVIPATAN DIVISION	BAHARAICH	14.00	19.29	3.21	45.00	19.29	14.00	20.00	6.00	115.71	19.29
	BALRAMPUR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	GONDA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SHRAVASTI	10.00	19.00	-19.00	-190.00	19.00	10.00	0.00	-10.00	-190.00	190.00
FAIZABAD DIVISION	AMBEDKARNAGAR	8.00	20.00	3.33	26.67	20.00	8.00	3.00	-5.00	-100.00	-16.67
	AMETHI	458.00	19.74	2.13	975.97	19.74	458.00	412.00	-46.00	-907.95	-98.02
	BARABANKI	552.00	19.73	2.19	1209.69	19.73	552.00	573.00	21.00	414.29	46.02
	FAIZABAD	2.00	20.00	10.00	20.00	20.00	2.00	1.00	-1.00	-20.00	-10.00
	SULTANPUR	134.00	19.70	2.08	278.98	19.70	134.00	157.00	23.00	453.13	47.88
GORAKHPUR DIVISION	DEORIA	148.00	19.32	2.43	360.00	19.32	148.00	148.00	0.00	0.00	0.00
	GORAKHPUR	9.00	18.89	3.61	32.50	18.89	9.00	8.00	-1.00	-18.89	-3.61
	KUSHINAGAR	103.00	19.32	2.04	210.00	19.32	103.00	103.00	0.00	0.00	0.00
	MAHARAJGANJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VARANASI DIVISION	CHANDAULI	4150.00	11.49	-2.50	-10372.85	11.49	4150.00	4903.00	753.00	8654.96	-1882.11
	GHAZIPUR	14763.00	10.49	-3.64	-53793.07	10.49	14763.00	15161.00	398.00	4173.30	-1450.22
	JAUNPUR	4937.00	11.74	0.74	3646.63	11.74	4937.00	5922.00	985.00	11565.82	727.55
	VARANASI	6195.00	9.50	8.90	55137.71	9.50	6195.00	5504.00	-691.00	-6567.57	-6150.15

(**Source:** Directorate of Economics and Statistics Uttar Pradesh).

Table 3. Calculated Value of CAGR of Area, Production, and Productivity of Pearl Millet in districts of Eastern Uttar Pradesh.

TABLE 3. CALCULATED VALUE OF CAGR OF AREA, PRODUCTION, AND PRODUCTIVITY OF PEARL MILLET IN DISTRICTS OF EASTERN UTTAR PRADESH

NAME OF DIST.	CAGR OF AREA PERCENT%	CAGR OF PRODUCTION PERCENT%	CAGR OF PRODUCTIVITY PERCENT%
AZAMGARH	0.53	3.05	2.51
BALLIA	-1.05	1.29	2.37
MAU	-0.42	1.46	1.89
BAHRAICH	7.39	10.76	3.13
BALRAMPUR	0.00	0.00	0.00
GONDA	0.00	0.00	0.00
SHRAVASTI	-100.00	-100.00	-100.00
AMBEDKAR NAGAR	-17.81	-15.24	3.13
AMETHI	-2.09	-0.07	2.07
BARABANKI	0.75	2.89	2.13
FAIZABAD	-12.94	-5.59	8.45
SULTANPUR	3.22	5.31	2.03
DEORIA	0.00	2.40	2.40
GORAKHPUR	-2.33	1.15	3.56
KUSHI NAGAR	0.00	2.03	2.03
MAHRAJGANJ	0.00	0.00	0.00
CHANDAULI	3.39	-1.56	-4.79
GHAZIPUR	0.53	-7.69	-8.18
JAUNPUR	3.71	4.98	1.23
VARANASI	-2.34	11.46	14.13

Source**:** Directorate of Economics and Statistics Uttar Pradesh

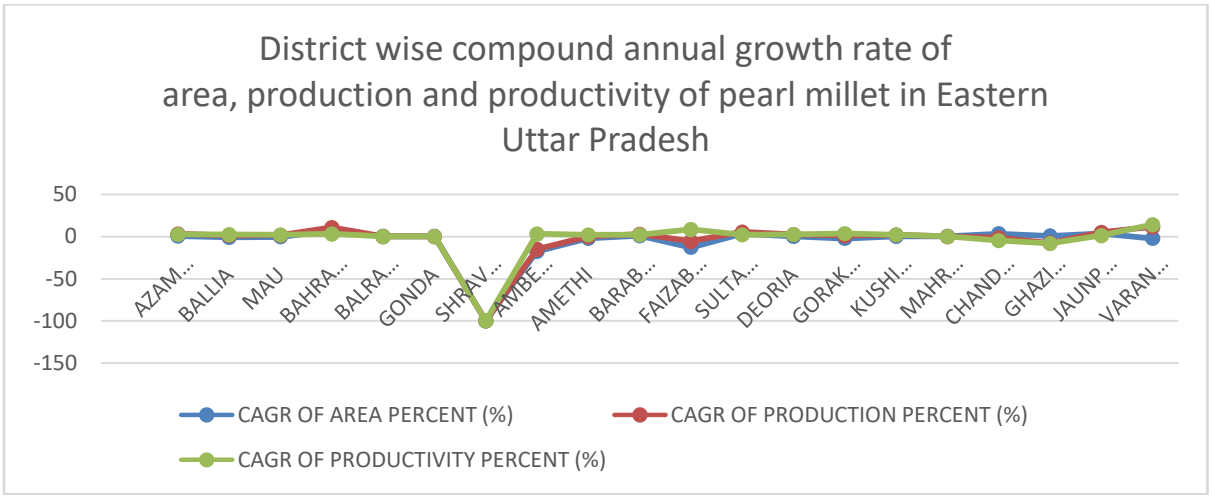

Figure 1 District wise compound annual growth rate of area, production and productivity of pearl millet in Eastern Uttar Pradesh

6. RESULT AND DISCUSSION

The analysis of area effects, as shown in **Table 2**, reveals varying impacts on pearl millet production across districts in Eastern Uttar Pradesh. Districts like **Jaunpur (11,565.82 quintals)**, **Chandauli (8,654.96 quintals)**, and **Ghazipur (4,173.30 quintals)** exhibit positive area effects, which can be attributed to favorable climatic conditions, better market demand, or supportive government policies encouraging the expansion of cultivated land. On the other hand, districts such as **Amethi (-907.95 quintals)**, **Ballia (-1,969.46 quintals)**, and **Varanasi (-6,567.57 quintals)** show adverse area effects. These declines may result from a shift to other crops, declining profitability of millet cultivation, limited research and development efforts, weak market and demand linkages, and insufficient awareness about the benefits of millet. **Deoria (0.00)** and **Khushinagar (0.00)**recorded no changes in production despite changes in the area, suggesting that factors other than land expansion, such as farming practices or market factors, might be limiting production.

For yield effects, **Table 2** shows that districts like **Varanasi (55,137.71 quintals)**, **Ballia (4,754.25 quintals)**, and **Jaunpur (3,646.63 quintals)** experienced high positive yield effects, indicating that improved farming practices or the adoption of better crop varieties contributed to higher production. In contrast, districts like **Ghazipur (-53,793.07 quintals)** and **Chandauli (-10,372.85 quintals)** showed negative yield effects, which may be linked to challenges such as pest infestations, inadequate agricultural practices, or soil degradation. As for interaction effects, **Jaunpur (7,275.50 quintals)**, **Sultanpur (478.80 quintals)**, and **Barabanki (460.20 quintals)** benefited from simultaneous improvements in both area and yield, likely due to coordinated efforts in improving both aspects. In contrast, **Varanasi (-61,501.50 quintals)** and **Chandauli (-1,882.11 quintals)**had negativeadverse interaction effects, which might result from inefficiencies or poor management when both area and yield were expanded together.

The **CAGR** analysis in **Table 3** reveals varied trends in area, production, and productivity across districts. Positive growth in Areas such as **Bahraich (7.39%)**, **Sultanpur (3.22%)**, **Jaunpur (3.71%)**, and **Chandauli (3.39%)** can be attributed to favorable climatic conditions, better market demand, or supportive government policies. On the other hand, districts like **Shravasti (-100.00%)**, **Ambedkar Nagar (-17.81%)**, and **Faizabad (-12.94%)** experienced negative growth, reflecting a shift to other crops, declining profitability, or weak market linkages. For production, **Bahraich (10.76%)** and **Varanasi (11.46%)** showed positive growth, likely due to improved farming techniques or favorable conditions. Conversely, districts like **Faizabad (-5.59%)** and **Ghazipur (-7.69%)**observed declining production, possibly because of adverse weather or poor crop management. Productivity gains, particularly in **Varanasi (14.13%)**, **Faizabad (8.45%)**, and **Gorakhpur (3.56%)** indicate improvements in farming practices. In comparison, reductions in productivity in **Ghazipur (-8.18%)** and **Chandauli (-4.79%)** suggest challenges such as poor crop management or pest issues. These findings emphasize the need for targeted interventions to address the problems hindering production and productivity in certain districts.

7.CONCLUSION

Based on this analysis, it is concluded that the diverse impacts of increasing cultivated area, yield improvements, and their interaction on pearl millet production vary across districts in Eastern Uttar Pradesh. The findings reveal distinct patterns of outcomes, with districts like Jaunpur,

Chandauli, and Ghazipur benefiting significantly from expanded land use, while others, including Varanasi and Ballia, experienced substantial declines.

The variations in yield effects, ranging from highly positive in districts such as Varanasi to negative in Ghazipur and Chandauli, highlight the complexity of agricultural performance across the region. The interaction between area and yield also presents mixed results, with some districts achieving substantial gains and others suffering from inefficiencies when both factors increase simultaneously. This suggests that local conditions, such as farming practices, robust research and development efforts, effective market and demand linkages, and widespread awareness of the nutritional and environmental benefits, play critical roles in determining the effectiveness of land and yield enhancements.

The Compound Annual Growth Rate (CAGR) trends further emphasize the need for region-specific approaches. While some districts, like Bahraich and Jaunpur, show promising growth, others face stagnation ordecline, particularly Shravasti and Faizabad, which may require specific measures to boost performance.

This study underscores the need for tailored strategies to address each district's challenges and opportunities. Policymakers, agricultural experts, and local farmers must collaborate to implement region-specific solutions through improved farming practices, resource management, or investment in research and development. By doing so, Eastern Uttar Pradesh can fully harness its agricultural potential, ensuring future sustainable growth and food security.

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CHANAKYA AND THE MODERN STATECRAFT: ANCIENT INSIGHTS FOR CONTEMPORARY FISCAL CHALLENGES

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ABSTRACT

This paper examines Chanakya's ideas on governance and taxation from the Arthashastra and their relevance to modern fiscal systems. Chanakya viewed taxation not just as a tool for revenue, but as a moral duty rooted in justice, equity, and public welfare. His tax system included context-based levies, accountability, and relief during crises—principles that align with modern public finance ideas like fairness, efficiency, and transparency. The study also compares his ideas with current practices such as GST and income-based taxation. While acknowledging the limitations of applying ancient ideas directly to today's democratic and complex economies, the paper concludes that Chanakya's philosophy still offers valuable lessons for ethical and people-centered fiscal governance.

KEYWORDS: *Chanakya, Arthashastra, Public Finance, Fiscal Governance, Ancient Economic Thought, Tax Policy*

1. INTRODUCTION

Taxation is a central pillar of statecraft and governance. From ancient civilizations to the present-day welfare states, taxation has functioned as both a tool for resource mobilization. The evolution of taxation systems has long been a subject of philosophical, economic, and administrative deliberation. While modern taxation theory is commonly traced back to classical economists like Adam Smith, who is widely recognized as the father of modern economics due to his seminal work *"An Inquiry into the Nature and Causes of the Wealth of Nations"* (1776), the intellectual roots of taxation go much deeper. Long before Smith, profound economic and administrative ideas were laid down by ancient Indian philosopher Chanakya, also known as Kautilya, through his magnum opus Arthashastra, written around 300 BCE. This ancient Indian treatise on statecraft, economic policy, and military strategy offers a deeply sophisticated and ethically nuanced philosophy of governance, with taxation forming a critical component. His *Arthashastra* comprises 15 books, each detailing aspects of administration, economic regulation, diplomacy, ethics, and taxation. The work, translated by scholars like Shastry (1915), Kangle

(1960s), and Rangarajan (1992), remains a rich source of economic philosophy that integrates moral, political, and financial governance.

Chanakya's philosophy on taxation, as articulated in the *Arthashastra*, emphasizes fairness, ethical governance, moderation, and state accountability. He envisioned the king (state) as a servant of the people, advocating for a tax system that was efficient yet just, revenue-generating yet non-exploitative. Unlike many ancient systems characterized by arbitrariness or coercion, Chanakya's model underscored the importance of predictability, equity, and welfare — tenets that closely align with modern principles of public finance.

In the contemporary era, taxation is governed by structured legal frameworks and economic theories such as those proposed by Adam Smith, Musgrave, and others. Modern tax systems prioritize equity (horizontal and vertical), efficiency, certainty, and administrative convenience. However, these principles are not novel. They echo, in many respects, the ethical and practical concerns that Chanakya addressed over two millennia ago. His philosophical orientation, combining pragmatism with a deep concern for *dharma* (ethical duty), has remarkable relevance in today's discussions on tax justice, fiscal responsibility, and citizen trust.

As nations today grapple with tax evasion, inequitable burdens, and declining public trust, revisiting Chanakya's insights can offer timeless wisdom. His call for moderate taxation, ethical conduct by revenue officers, and the prioritization of public welfare over royal luxury remain profoundly relevant. By exploring these principles in relation to modern taxation theories and practices, this paper seeks to contribute a historically grounded yet forward-looking perspective to the evolving discourse on taxation and public finance.

This paper investigates the philosophical relevance of Chanakya's thoughts on taxation within the framework of modern taxation systems. It seeks to identify key philosophical elements from the *Arthashastra*, analyze their parallels in contemporary fiscal theory, and evaluate their applicability to modern tax policy. In doing so, this study aims to highlight the enduring value of ancient Indian wisdom in informing equitable and effective governance today. It will juxtapose his principles with modern economic thought and evaluate how ancient wisdom can enrich contemporary fiscal policy.

2. Chanakya's Philosophical Foundations and Ethics of Governance

Chanakya's philosophical vision of governance was deeply rooted in Dharma (righteousness), Artha (wealth), Kama (desire), and Moksha (liberation)—the fourfold goals of life according to ancient Indian tradition. Among these, *Artha* was considered the foundation upon which the other three rested. Chanakya's Arthashastra articulates that a king's primary duty is to ensure the prosperity and stability of the state, which is only achievable through ethical governance and efficient economic administration (Kangle, 1965).

His philosophy drew upon **utilitarian and realist traditions,** combining idealism with pragmatism. He emphasized that the ruler must prioritize *lokasangraha* (welfare of the people), not merely the accumulation of wealth (Rangarajan, 1992). This aligns closely with the modern social contract theory, wherein the legitimacy of taxation and governance arises from their service to public welfare (Smith, 2007).

Chanakya advocated for a **ruler who was a servant-leader**, one who wielded authority for the people's good rather than for personal gain. He emphasized self-discipline, detachment, and ethical conduct in statecraft. His famous maxim, *"In the happiness of the subjects lies the*

happiness of the king", underscores a human-centric governance model that parallels modern public finance principles like **equity, accountability, and transparency** (Boesche, 2003).

Further, Chanakya's ethical realism justified espionage and diplomacy if it safeguarded the kingdom, but simultaneously condemned tyranny, corruption, and fiscal irresponsibility. He believed that rulers must lead by example and protect the treasury as a moral and sacred responsibility (Shastri, 1915). These philosophical foundations reflect a proto-public-choice theory, where individual incentives and institutional design must align for good governance.

His governance model integrates **ethics with administrative efficiency**, offering insights into sustainable and morally grounded tax systems. Modern taxation, when viewed through Chanakya's lens, must serve social justice, resource redistribution, and economic growth without undermining public trust or administrative morality (Sihag, 2014).

3. Kautilyan Taxation Principles in Arthashastra

Chanakya's *Arthashastra*offers a timeless and ethical blueprint for fiscal governance. His vision of taxation—as a balanced, fair, and strategic institution—remains relevant in contemporary debates over fiscal justice, state legitimacy, and economic development. By integrating dharma (duty) and artha (wealth), Chanakya placed public welfare at the center of fiscal policy, offering valuable lessons for modern states striving for equity, efficiency, and accountability. Chanakya's Arthashastra presents taxation as both a fiscal and ethical instrument of governance. He proposed a well-defined revenue structure encompassing various forms of taxes, including:

- Customs duty *(shulka)* consisting of import duty *(pravesya)*, export duty *(nishkramya)*, octroi, and other gate tolls *(dwarabahirikadeya)*
- Transaction tax *(vyaji)* including *manavyaji* (transaction tax for Crown goods)
- Share of production *(bhaga)*
- Tax in cash as a tribute from conquered territories*(kara)*
- Taxes in kind *(pratikara)*, Labour *(vishti)* and Supply of soldiers *(ayudhiya)*
- Countervailing duties or taxes *(vaidharana)*
- Road cess *(vartani)*
- Monopoly tax *(parigha)*
- Royalty *(prakriya)*
- Taxes paid in kind by villages *(pindakara)*
- Army maintenance tax *(senabhaktham)*
- Surcharges *(parsvam)*
- Agricultural tax *(Bali)*
- Commercial levies *(Vanikpatha)*
- Emergency taxation (*Pranaya)*

These taxes were levied in proportion to the productivity of economic units and were subject to audit and oversight (Kumar, 2019). The idea was to fund public goods and security while avoiding economic exploitation. Chanakya's tax system was marked by three key features:

- **Elasticity and Flexibility**: Taxes were adjusted based on economic circumstances, such as crop failures or wartime exigencies. Relief and exemptions were provided in times of distress (Rangarajan, 1992).
- **Equity and Justice**: The principle of *samya* (equality) guided the tax structure. He recognized the economic capacity of different groups and ensured that taxation did not unduly burden the poor (Mukherjee, 2020).
- **Accountability**: Chanakya insisted on record-keeping, audits, and rotation of officials to avoid corruption and embezzlement (Kangle, 1965).

In modern parlance, these align closely with the principles of horizontal equity, vertical equity, and accountability in public finance. Chanakya's *Arthashastra* outlines a remarkably sophisticated system of taxation that mirrors many tenets of modern public finance. Taxation, for Chanakya, was not merely a means of revenue generation but a tool for ensuring economic balance, state stability, and public welfare. His principles on taxation were embedded within the broader context of ethics, justice, and pragmatism.At the core of Kautilya's philosophy was the concept of dharma (duty) and artha (wealth). The king, acting as the custodian of the state, was expected to collect taxes ethically, ensuring the burden on subjects remained just and sustainable. He advised that taxes should be **"like a bee that sucks honey from the flower without hurting it"** (*Arthashastra*, Book II, Chapter 6; Kangle, 1965), reflecting an early awareness of the Laffer Curve-like effect—over-taxation reduces the ability and willingness to pay (Singh & Thomas, 2022).

Kautilya recognized the **elasticity of taxation** and recommended **a flexible tax system** tailored to the income levels and occupational conditions of different groups. Farmers, artisans, traders, and merchants were taxed differently, based on their capacity to pay (Rangarajan, 1992). He distinguished between direct and indirect taxes, such as land tax (*bhaga*), trade duties (*sulka*), and tolls (*vartanika*), suggesting a nuanced understanding of public finance mechanisms (Boesche, 2003).Moreover, *Arthashastra* emphasizes transparency and accountability in tax administration. Tax collectors were strictly supervised, and corruption was met with severe punishment (Kangle, 1965). This aligns with modern principles of tax governance, which stress compliance, equity, and deterrence of evasion.Chanakya also proposed **seasonal and situational tax reliefs**. For instance, during natural calamities or wars, tax burdens were reduced or suspended to protect the livelihoods of citizens—a principle echoed in today's fiscal stimulus and relief packages (Sihag, 2014).The integration of **economic rationality with ethical governance** in Kautilya's tax theory makes it not only historically significant but also **philosophically relevant to modern fiscal policy design.** His ideas resonate with contemporary calls for equitable, efficient, and transparent taxation systems.

4. Comparison with Modern Taxation Principles

The taxation system articulated by Chanakya in the *Arthashastra* demonstrates a striking resemblance to several principles that form the foundation of modern taxation. Although formulated over two millennia ago, Kautilya's ideas align with contemporary notions such as

equity, efficiency, certainty, and administrative feasibility—principles later formalized by Adam Smith in *The Wealth of Nations* (Smith, 2007).

TABLE 1: COMPARATIVE ANALYSIS OF CHANAKYA'S TAXATION DICTUMS AND MODERN PUBLIC FINANCE PRINCIPLES

Principal	**Chanakya's Principle**	**Explanation with Source**	**Modern Equivalent / Relevance**
Equity and Justice	Tax equity based on ability to pay	*"A king shall levy taxes in proportion to the income of his subjects, just as the sun draws moisture from the earth"* (Arthashastra, Book V, Ch. 2). Taxes varied across agriculture, trade, mining, and professions based on capacity (Rangarajan, 1992).	Reflects horizontal equity and vertical equity — key concepts in public finance (Musgrave & Musgrave, 1989).
Efficiency and Minimal Burden	Avoid Over-burdening taxpayers	*"The king shall collect taxes like a bee that sucks honey without harming the flower"* (Arthashastra, Book II, Ch. 6). Chanakya promoted minimal interference with economic activity (Sihag, 2014).	Modern public finance emphasizes non-distortionary taxation and the Laffer Curve warns against excessive taxation (Laffer, 2004).
Certainty and Simplicity	Codified and predictable tax rules	*"The rules regarding tax collection shall be written and known to all"* (Arthashastra, Book II, Ch. 7). Chanakya emphasized transparency and predictability (Kangle, 1965).	Aligns with Adam Smith's canon of certainty — tax liabilities must be clear to every taxpayer (Smith, 2007).
Administrative Efficiency and Accountability	Oversight of tax officials	*"The collector shall keep daily records… any deviation shall be punished"* (Arthashastra, Book II, Ch. 8). Chanakya supported audits and strict action against corrupt officials (Rangarajan, 1992).	Mirrors modern tax administration systems, emphasizing audit trails, transparency, and anti-corruption mechanisms (Bird, 2003).
Responsive Taxation and Social Welfare	Tax relief during distress	*"In times of calamity… the king shall remit taxes to relieve the burden on the people"* (Arthashastra, Book IV, Ch. 13). Flexible taxation in response to natural or economic crises (Boesche, 2003).	Parallel to modern fiscal policies like automatic stabilizers, tax relief packages, and stimulus measures (Stiglitz, 2015).

Source: Compiled by authors from the sources mentioned in the table

5. Lessons for Contemporary Fiscal Policy

Chanakya's *Arthashastra* offers enduring fiscal insights that resonate with today's challenges of governance, economic inequality, and efficient taxation. His emphasis on ethical taxation, citizen welfare, and accountable administration provides valuable guidance for modern fiscal policymakers, especially in developing economies like India.

TABLE 2: LESSONS FROM CHANAKYA'S ARTHASHASTRA FOR CONTEMPORARY FISCAL POLICY AND GOVERNANCE

Chanakya's Principle	Explanation with Source	Modern Equivalent / Relevance (with References)
Fiscal discipline and surplus creation	Chanakya insisted that *'expenditure should follow revenue, not precede it*' and emphasized saving surplus in prosperous times (Arthashastra, Book II, Ch. 15; Kangle, 1965).	Parallels modern counter-cyclical fiscal policy — saving during booms, spending during downturns (Musgrave & Musgrave, 1989; Stiglitz, 2015).
Fair taxation and state legitimacy	Kautilya asserted that taxation was legitimate only if the state reciprocated with protection and welfare, framing it as a social contract (Arthashastra, Book I, Ch. 13; Rangarajan, 1992).	Echoes the democratic principle of taxpayer accountability — legitimacy through transparency and services (Bird, 2003).
Temporary tax relief during crises	Chanakya wrote that *'in times of famine or disaster, taxes shall be reduced or suspended to ease the people's burden*' (Arthashastra, Book IV, Ch. 13; Boesche, 2003).	Comparable to modern progressive tax relief and fiscal stimulus, e.g., during COVID-19 (Stiglitz, 2020; IMF, 2021).
Strict oversight to curb corruption	Kautilya mandated strict audits and penalties: *'A corrupt official shall be punished like a serpent hiding in the anthill*' (Arthashastra, Book II, Ch. 9; Sihag, 2014).	Aligns with digital audits, whistleblower protections, and anti-corruption tools in public finance (OECD, 2020).
Region-specific taxation policies	Chanakya recommended *'differentiated taxation based on local conditions like soil fertility and climate*' (Arthashastra, Book II, Ch. 24; Rangarajan, 1992).	Reflected in fiscal federalism and localized taxation in modern governance (Bird & Vaillancourt, 2008).
Strategic use of national resources	Kautilya emphasized that *'the king shall operate key industries and monopolies for state prosperity'* (Arthashastra, Book II, Ch. 15; Kangle, 1965).	Resonates with modern developmental state strategies, public sector enterprises, and industrial policy (Chang, 2003).

Source: Compiled by authors from the sources mentioned in the table

6. Relevance of Chanakya's Principles in Contemporary Indian Tax System

Chanakya's taxation philosophy, as outlined in the *Arthashastra*, revolves around the ideas of justice, proportionality, and state responsibility. His emphasis on dharma (righteousness) as a guiding principle in taxation aligns with modern ideals of equity and efficiency in tax systems. The Goods and Services Tax (GST) reform in India, which aims to create a unified and fair tax regime, reflects Chanakyan ideas of simplification and standardization of taxation for greater economic cohesion (Kumar, 2019).

Chanakya advocated for a tax system that is neither burdensome nor erratic. He emphasized that taxes should be collected like a bee collects honey—gently and without destroying the flower (*Arthashastra*, Book 2, Chapter 6). This mirrors the modern progressive taxation framework and income-slab-based personal taxation adopted in India under the Income Tax Act, 1961, ensuring the tax burden falls more heavily on those with higher capacity to pay (Sharma & Rao, 2021).

Chanakya's attention to agricultural income and land-based taxation has contemporary relevance in discussions surrounding rationalization of agricultural subsidies and the inclusion of large farm incomes in the tax net. The recent Direct Tax Code (DTC) discussions and simplification efforts reflect similar goals of rational and inclusive tax policy, resonating with the clarity and purpose-driven taxation found in the *Arthashastra* (Mukherjee, 2020).

Moreover, GST's compliance-focused mechanism and technology-based administration parallel Chanakya's emphasis on record-keeping, surveillance, and state control to prevent revenue leakage—showing that technological evolution has only refined, not replaced, ancient administrative logic.

7. Critical Reflections and Contemporary Challenges in Applying Chanakya'sFiscal Philosophy

The *Arthashastra*, authored by Chanakya (Kautilya), remains a cornerstone of ancient Indian political and economic thought. It presents taxation not merely as a tool for revenue generation but as a moral and strategic instrument to sustain statecraft. However, the direct application of these ancient principles to modern fiscal systems is fraught with conceptual, ethical, and structural challenges. While the text offers valuable normative insights, its translation into contemporary governance requires careful reinterpretation.

7.1. From Monarchical Control to Democratic Accountability

Chanakya's model was rooted in an autocratic political structure where the king was the supreme authority:

"The king is the embodiment of law; he is the source and protector of all laws"

(*Arthashastra*, Book I, Ch. 4; Rangarajan, 1992).

Such centralized control enabled swift decision-making, particularly in matters of revenue. In contrast, modern democracies function through **constitutional separation of powers**, federal institutions, and participatory governance (Boesche, 2003). Thus, Chanakya's top-down approach faces limitations in decentralized systems where tax policymaking is negotiated across multiple layers of authority.

7.2. Social Inclusivity and Equity Blind Spots

Although Chanakya emphasized administrative efficiency and public welfare, his framework did not systematically address social equity. The *Arthashastra* often aligned state policy with the interests of the ruling class and economic elites. There is minimal mention of gender equality or caste-based inclusion, which are **core pillars of modern inclusive fiscal policies** (Sihag, 2014). Applying *Arthashastra* uncritically may risk reinforcing traditional hierarchies and socio-political exclusions.

7.3. Neglect of Environmental Ethics

The *Arthashastra* promotes wealth accumulation and resource extraction in service of state strength:

"The king shall exploit mines, forests, pastures, and water bodies for revenue"

(*Arthashastra*, Book II, Ch. 15; Kangle, 1965).

While efficient in its time, this anthropocentric and utilitarian approach lacks environmental foresight. Today, climate change and ecological degradation demand fiscal frameworks that incorporate sustainability and green taxation—dimensions absent from Chanakya's worldview (Stiglitz, 2020).

7.4. Technological and Economic Evolution

Chanakya's taxation model was crafted for a primarily agrarian society. He imposed levies such as *bhaga* (share of produce), *shulka* (customs duties), and *vartani* (road cess), appropriate for an economy centered around land and trade. However, modern economies are increasingly digital, globalized, and driven by intangible assets. Complex issues like transfer pricing, cryptocurrency regulation, and capital mobility fall **outside the scope of ancient fiscal logic** (Gupta, 2021). Hence, while the principles of fairness and accountability endure, the tools require modern adaptation.

7.5. Surveillance, Coercion, and Ethical Governance

Chanakya endorsed rigorous internal monitoring to maintain administrative integrity:

"A corrupt official is like a hidden thorn… he must be uprooted with punishment"

(*Arthashastra*, Book II, Ch. 9; Rangarajan, 1992).

"Spies shall be employed to observe the conduct of officials and the people"

(*Arthashastra*, Book I, Ch. 12).

While these strategies ensured discipline, they also relied heavily on covert surveillance and authoritarian enforcement. In contrast, modern governance emphasizes transparency, citizen rights, and due process over punitive and secretive mechanisms (Sen, 1999).

7.6. Static Economic Foundations and Limited Global Scope

The *Arthashastra* reflects a relatively static, internally focused economy. It does not account for technological disruption, international trade treaties, or financial derivatives—hallmarks of the 21st-century global economy (Boesche, 2003). While Chanakya distinguished between direct and indirect taxes, such as *vyaji* (transaction tax) and *kara* (tribute), the text lacks frameworks for managing **volatile capital markets or supranational tax coordination.**

7.7. Moral Instrumentalism and Normative Gaps

Chanakya's ethical outlook was largely utilitarian, aiming at the strength and stability of the state rather than universal moral ideals:

"Whatever pleases the king and strengthens the state is to be treated as right"

(*Arthashastra*, Book I, Ch. 7; Parashar, 2015).

This instrumental use of ethics, though effective for governance, may conflict with modern deontological frameworks that emphasize human rights, moral universality, and participatory justice.

Despite these challenges, Chanakya's fiscal philosophy offers valuable normative guidance. His emphasis on **tax fairness, administrative accountability, public welfare, and ethical governance** remains relevant in the design of modern taxation systems. Rather than serving as a literal model, the *Arthashastra* should be interpreted as a **philosophical framework**—providing

timeless insights into the **moral and strategic underpinnings** of public finance in complex societies.

8. Conclusion and Policy Recommendations

Chanakya's *Arthashastra*, written over two millennia ago, is a testament to ancient India's sophisticated understanding of statecraft, economics, and taxation. As a moral philosopher and economic strategist, Chanakya conceptualized a system where the **state's financial stability, administrative efficiency, and ethical governance** were interwoven into a cohesive framework (Rangarajan, 1992; Boesche, 2003). His vision of taxation as a **means to strengthen the state and support public welfare** still holds philosophical and fiscal relevance in the modern era (Sihag, 2014).

The present analysis has revealed that several of Chanakya's taxation principles—such as gradualism in tax burden, equitable contribution, strategic use of fiscal incentives, and corruption deterrence mechanisms—are echoed in modern economic frameworks, including progressive taxation, GST regimes, and compliance-driven fiscal policies (Stiglitz, 2020; Bird & Zolt, 2005). However, critical reflections also reveal significant limitations. His framework was designed for an autocratic monarchy with minimal attention to individual freedoms, participatory governance, environmental sustainability, and social justice (Sen, 1999; Parashar, 2015).

Nonetheless, if interpreted through a philosophical and reformist lens, Chanakya's economic thinking offers **timeless principles** adaptable to modern fiscal institutions and ethical governance.

Policy Recommendations

Drawing from Chanakya's fiscal philosophy, several key lessons can inform modern taxation policy. First, taxation should be understood as an **ethical duty of the state**, not merely a tool for economic efficiency. Chanakya envisioned taxation as a moral responsibility of the ruler—one that must uphold equity, fairness, and public welfare. Second, his emphasis on **context-sensitive levies** offers a compelling case for progressive and regionally responsive taxation. Just as he differentiated taxes based on occupation, land productivity, and local needs, contemporary systems should balance direct and indirect taxes in line with income distribution, consumption behavior, and regional disparities (Bird & Zolt, 2005).

Third, Chanakya's robust surveillance mechanisms underscore the need to **embed anti-corruption frameworks within fiscal administration.** While the methods today must differ, his intent can be realized through digitized transparency, independent audits, public oversight, and ethical incentives within revenue departments. Fourth, his philosophy of *Dandaniti*—just enforcement—can be reinterpreted to ensure **economic justice** in policy design, safeguarding taxpayer rights, minimizing arbitrariness, and promoting compassionate compliance.

Fifth, the integration of classical texts like the *Arthashastra* into **public policy and economic education** can enrich students' understanding of indigenous contributions to fiscal thought and governance. Finally, while ancient wisdom provides philosophical inspiration, its application must be filtered through **critical reflection.** It is important to adapt rather than adopt these doctrines wholesale, ensuring that reinterpretation aligns with the values of modern democracy, inclusivity, and environmental sustainability.

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