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Building an Optimal Portfolio: Exploring Risk and Return in Five Distinct Sectors

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Abstract: ***This study uses a quantitative research design to examine the risk and return characteristics of assets in five diverse sectors and build an optimal investment portfolio. To fulfil the research objectives, historical data and financial measurements were used. Standard financial performance indicators have been created to analyse the risk and return characteristics of assets within each sector. The metrics were utilized to analyse the data in this study are expected return, standard deviation, beta and Treynor ratio. Comparative evaluations have been performed to compare each sector's risk and return profiles. Statistical tests, such as Covariance, used to find significant differences in returns and risk measures between sectors. To create optimal investment portfolios, efficient portfolio creation approaches such as mean-variance optimization have been used. The goal is to find asset allocations that maximize returns for different levels of risk tolerance. Portfolios were built using various asset pairings from the five sectors.***

Keywords: Beta, Risk and Return, Portfolio, Investment

I. INTRODUCTION

Risk is an inherent characteristic of any investment, be it controllable or uncontrollable, and cannot be entirely eliminated in the natural course of investing. However, diversification of a portfolio, particularly in the share market, offers an effective way to reduce risk. Before investors venture into the share market, it is essential for them to acquaint themselves with fundamental information concerning risk, the various types of risks they may encounter, and other pertinent details about their potential investments. In this context, numerous investment theories have been introduced to investors, and one such prominent theory is the Treynor Ratio. The Treynor Ratio is a tool that helps investors decide how well an investment has performed considering the risk it took. It's like figuring out if the reward was worth the risk. Think of it as a way to measure how much extra return you got for the amount of risk you accepted. If an investor is investing their money in the market. They would expect a good return, but they also want to be careful with risks. The Treynor Ratio looks at how much more return they can earn (return) compared to the future uncertainties (risk). Therefore, understanding the beta of a stock is crucial for investors as it provides valuable insights into the stock's risk characteristics and its potential behaviour compared to the broader market. By assessing beta, investors can make informed decisions about constructing a well-diversified portfolio that aligns with their risk tolerance and investment objectives.

Individual Stock Return. The rate of return is one of the various factors that motivate investors to interact and is also included in the reward for the courage of investors to take risks on the investments made (Utami, 2015). Lack of return from the expected value or value, uncertainty of future returns, and the chance of the opposite happening are examples of risk. The following are the dangers that will be faced, according to perspective

$$Rt = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

Return market. The market rate of return is the return that investors get from investing in various stocks as reflected by changes in the price index within a certain period of time.

Risk free return. The risk-free rate of return is the return that investors get based on an agreed-upon agreement without any risk. Based on the perspective (Husnan, 2015) explains that the risk-free rate of return is a measure of the minimum rate of return at the time of beta risk (βi) which has a value or is zero.

$$R_f = \frac{\Sigma Rf}{N} \quad (2)$$

Beta Market. The risk of stock price fluctuations in the market is measured by beta (β). In other words, beta is the standard deviation of stock returns when compared to market returns. Beta (β) can alternatively be defined as the relationship between market and stock returns.

$$\beta = \frac{\mathrm{cov}(r_i, r_m)}{\sigma^2(r_m)} \quad (3)$$

II. NEED FOR THE STUDY

In today's investment landscape, many investors seek to maximize their returns by investing in riskier assets, driven by the prevailing belief that "Higher the Risk, Higher the Return." However, successful investments require more than just committing funds; investors must possess a fundamental understanding of stock market analysis and various theories related to risks and returns associated with stocks. To address this need, we have undertaken a study to provide a comprehensive understanding of estimating β (beta) values for different stocks across various sectors. The primary aim of this research is to assist high-risk-taking, yet novice investors in constructing well-balanced portfolios and optimizing their investment returns, considering the uncontrollable risk factors inherent in the market.

The study specifically focuses on five thriving sectors in the Indian stock market (BSE): Information Technology, Banking, Automobile, Fast Moving Consumer Goods and Pharmaceuticals. These sectors are known for their robust performance, making them attractive investment opportunities. The researchers have meticulously selected three top-performing companies from each sector, based on their historical track records in the stock market. By doing so, they hope to offer valuable insights for investors to make informed decisions and capitalize on the potential growth opportunities in these sectors.

III. OBJECTIVES OF THE RESEARCH

1) To calculate risk and return and estimate the β of various stocks
2) To choose 50 stocks from 5 different sectors and analyse their β values
3) To develop a well-diversified portfolio by picking up shares which have a lower βs.

IV. LITERATURE REVIEW

The purpose of the research was to build portfolios using a variety of risk models, evaluate how well those portfolios performed, and draw conclusions about how applicable those models are to a range of various economic contexts[1]. They constructed portfolios with the help of several different risk models, including Value at Risk (VaR), Conditional Value at Risk (CVaR), and Expected Shortfall (ES), and then compared the performance of the portfolios. According to the findings of the study, the CVaR model was superior to the other models in terms of the risk-adjusted returns it generated[2].

According to the findings of the study, a portfolio model should be developed that takes into account both return predictions and transaction costs[3]. In order to make accurate projections of future returns, they utilized a model that is a combination of two other models, namely the autoregressive integrated moving average (ARIMA) model and the support vector regression (SVR) model. According to the findings of the research, the suggested model performed better than other models in terms of risk-adjusted returns[4].

A Monte Carlo simulation was performed in the research to assess the degree of danger posed by a portfolio of equities drawn from the ISE-100 index of the Istanbul Stock Exchange. In the study, Value at Risk (VaR) was utilized to determine how dangerous the portfolio was[5]. According to the findings, the investment portfolio was subject to a significant amount of risk; hence, the research suggested employing risk management strategies including diversification and hedging in order to cut down on the risk[1].

An effective methodology for optimizing portfolios is presented, which makes use of the Conditional Value at Risk (CVaR) metric as the risk gauge. In the research, a genetic algorithm was employed to determine the best portfolio to use[6]. According to the findings, the model that was proposed had a better performance in comparison to other models in terms of risk-adjusted returns.

An optimization model for portfolios that makes use of both deep learning and machine learning to forecast future returns is presented here. In the research, a deep neural network (DNN) was utilized to forecast return rates, and a genetic algorithm was used to determine the best portfolio allocation[7]. According to the findings, the model that was proposed had a better performance in comparison to other models in terms of risk-adjusted returns. Using the Sharpe single index approach, the research focuses on finding the best way to design a portfolio for investing in the Indian stock market.

In another piece of research, the construction of an optimal investment portfolio was done with the use of genetic algorithms in order to use data obtained from the stocks of companies that are traded on the Nigerian exchange market[2]. The strategy took into account crucial aspects including the risk, the liquidity ratio, the returns, the diversification, and the asset allocation.

Several research made an effort to develop an ideal portfolio for investing in Indian equity firms that correspond to a variety of economic sectors. In one of these studies, the manufacturing industry was analyzed[7].

This research effectively applies the Mean–variance, Downside, and Semi-variance portfolio optimization methods to the data from two consecutive years of the Turkish day-ahead electricity market[3]. The employment of a variety of optimization approaches, which are common in financial literature but restricted in the context of optimizing power markets demonstrates risk management through diversity as a strategy[4]. For each optimization method, efficient frontiers, utility functions, and corresponding optimal portfolio solutions can be derived.

Investing involves committing current financial resources with the expectation of generating profits in the future. Investors purchase shares, anticipating gains from rising stock prices or receiving dividends over time[6]. These individuals participating in investment activities are commonly known as investors. The returns on stocks are referred to as realized returns, which are derived from historical data and serve as indicators of a company's performance[2]. These realized returns are crucial for predicting expected returns for future investors. It is important to acknowledge that all investments carry a certain level of risk or uncertainty[5]. As investments are made, there is always a possibility that the actual returns may not meet initial expectations.

V. INDUSTRY AND COMPANY ANALYSIS FOR BETA CALCULATIONS

The researchers developed their own criterion for selecting sectors and related Companies in order to build the best diversified portfolio with the lowest betas. The following conditions were carefully examined for the selection of Industries and Companies, as listed below:

1) Sector specific fundamental analysis for the selection of stocks from various sectors.
2) Historical returns, Standard Deviation, Beta of the concerned companies (IT, Banking, Automobile, FMCG and Pharmaceuticals) eight companies taken from each sector
3) 10 years companies return and Index return (SENSEX)

Particulars	Description
Sample Size	Sectors: - 5 Sectors chosen from the Index i.e., Information Technology, Banking, Automobile, FMCG, and Pharmaceutical. Companies: - 40 Companies selected
Data Collection	The particular Sectors and companies where selected based on industry, company and other required assessments in which 10 years data is considered for the study
Research Design	Descriptive and Quantitative
Sources of Data	The secondary data has been collected though Yahoo Finance and BSE India (10 Years data from 2013 - 2023 is taken for the research)
Method of Calculating Beta	Beta has been calculated using Risk Free Rate of Return and Treynor Ratio.

VI. RESEARCH METHODOLOGY

This report presents a comprehensive risk-return analysis of various sectors in the market, exploring the relationship between risk and return within each sector. By examining four distinct sectors - Information technology, Banking, Pharmaceutical, Automobile and FMCG. We aim to provide insights into the potential benefits and challenges associated with diversifying across different industries. The study delves into historical data, statistical metrics, and portfolio simulations to help investors make informed decisions for optimizing risk-adjusted returns in their investment strategies. This research investigates the most favourable equity portfolios in the Indian capital markets as of June 31, 2023. It considers various objectives and constraints while analysing the return and risk data from the past Ten years. The study aims to validate the risk-return correlation for these optimal portfolios and sheds light on the nature of this relationship, providing reasoned justifications for its findings.

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VII. ANALYSIS AND INTERPRETATION

Table 1: Basic inputs of the selected samples

COMPANIES (X)								
Stocks	Mean	Variants	Standard Deviation	Covariant	Beta	Total Risk	Systematic Risk	Unsystematic Risk
Infosys	-0.03	0.15	0.39	0.01	1.12	39%	13%	26%
TCS	0.06	0.04	0.19	0.01	1.13	19%	13%	6%
HCL	0.19	0.60	0.77	0.05	3.68	77%	42%	35%
Tech Mahindra	0.08	0.21	0.46	0.03	2.66	46%	30%	16%
Birla Soft	0.33	0.85	0.92	0.04	2.76	92%	32%	60%
Mphasis	0.25	0.20	0.45	0.01	0.79	45%	9%	36%
Coforge	0.38	0.23	0.48	0.01	1.02	48%	12%	36%
Wipro	0.03	0.16	0.40	0.01	0.74	40%	8%	32%
HDFC Bank	0.13	0.06	0.25	0.01	0.89	25%	10%	15%
ICIC BANK	0.06	0.11	0.34	0.00	-0.16	34%	-2%	36%
SBI	0.02	0.16	0.40	0.00	-0.28	40%	-3%	43%
Kotak Bank	0.14	0.10	0.32	0.03	2.09	32%	24%	8%
IDFC Bank	0.10	0.16	0.40	0.03	2.17	40%	25%	16%
Bank of Baroda	0.07	0.35	0.59	0.02	1.75	59%	20%	39%
Axis Bank	0.02	0.08	0.28	-0.01	-0.69	28%	-8%	35%
Yes Bank	-0.08	0.38	0.62	0.00	-0.31	62%	-4%	66%
Tata Motors	0.18	0.38	0.61	0.03	2.05	61%	24%	38%
Maruti	0.23	0.13	0.37	0.02	1.63	37%	19%	18%
TVS Motors	0.49	0.69	0.83	0.06	4.62	83%	53%	30%
Ashok Leyland	0.36	0.40	0.64	0.04	2.66	64%	31%	33%
Eicher Motors	0.20	0.55	0.74	0.04	2.79	74%	32%	42%
Hero MotoCorp	0.07	0.06	0.24	0.01	0.97	24%	11%	13%
Bajaj Auto	0.11	0.03	0.16	0.01	0.58	16%	7%	9%
M & M	0.08	0.08	0.28	0.00	-0.25	28%	-3%	31%
Hindustan Unilever	0.18	0.05	0.22	0.01	0.98	22%	11%	10%
Nestle India	0.17	0.03	0.16	0.01	0.68	16%	8%	8%
Britannia	0.24	0.15	0.39	0.02	1.49	39%	17%	22%
Marico	0.12	0.05	0.22	0.02	1.50	22%	17%	5%
Colgate	0.07	0.05	0.23	0.02	1.22	23%	14%	9%
P&G	0.32	0.22	0.47	0.00	0.07	47%	1%	46%
Tata Consumer	0.27	0.32	0.57	0.04	2.78	57%	32%	25%
Zydus Wellness	0.12	0.05	0.21	0.01	0.96	21%	11%	10%
Sun Pharma	0.10	0.07	0.26	0.02	1.20	26%	14%	12%
Lupin	0.05	0.09	0.30	0.00	0.20	30%	2%	28%
Cipla	0.14	0.08	0.28	0.02	1.22	28%	14%	14%
Dr. Reddy	0.11	0.09	0.30	0.00	0.37	30%	4%	25%
Abbott India	0.35	0.16	0.40	0.02	1.51	40%	17%	23%
Aurobindo Pharma	0.25	0.59	0.77	0.04	3.37	77%	39%	38%
Biocon	0.03	0.20	0.44	-0.02	-1.75	44%	-20%	64%
Glenmark	0.12	0.18	0.42	0.00	-0.20	42%	-2%	44%
Mean	0.13	Risk Free Rate = 364-days T-Bills: 6.4295%						
Variants	0.01	Sharpe Measure = (Rp-Rf)/(SD)						
Standard Deviation	0.11	Treynor Measure = (Rp-Rf)/(Beta)						

Table 2: Balanced Market Portfolio							
SL No.	Stocks	Rp	Rf	(Rp-Rf)	Beta	Treynor = (Rp-Rf)/Beta	Rank
1	Infosys Ltd	-27%	6%	-33%	1.12	-0.297207061	1
2	Tata Consultancy Services Ltd	63%	6%	57%	1.13	0.499612194	6
3	Coforge Ltd	376%	6%	370%	1.02	3.64394223	15
4	HDFC bank Ltd	126%	6%	119%	0.89	1.336047525	10
5	Axis bank Ltd	17%	6%	11%	-0.69	-0.156077211	2
6	Bank of Baroda	71%	6%	65%	1.75	0.371062675	7
7	Maruti Suzuki India ltd	231%	6%	225%	1.63	1.374787359	11
8	Hero MotoCorp ltd	67%	6%	60%	0.97	0.62053232	4
9	Bajaj auto ltd	109%	6%	102%	0.58	1.759707277	13
10	Hindustan Unilever	179%	6%	172%	0.98	1.755775932	12
11	Colgate-Palmolive (India) ltd	67%	6%	61%	1.22	0.499651195	5
12	Zydus wellness ltd	124%	6%	117%	0.96	1.218461253	9
13	Sun pharmaceutical industries ltd	99%	6%	92%	1.20	0.771852315	3
14	Cipla ltd	141%	6%	135%	1.22	1.103302855	8
15	Abbott India ltd	349%	6%	342%	1.51	2.262299728	14

Table 3: Aggressive Growth Portfolio							
SL No.	**Stocks**	**Rp**	**Rf**	**(Rp-Rf)**	**Beta**	**Treynor = (Rp-Rf)/Beta**	**Rank**
1	HCL infosystems ltd	187%	6%	181%	3.68	0.490841277	5
2	Tech Mahindra ltd	84%	6%	77%	2.66	0.291439429	2
3	Birla soft ltd	328%	6%	321%	2.76	1.16414516	11
4	Kotak Mahindra bank ltd	1212%	6%	1205%	2.09	5.755095856	15
5	IDFC limited	96%	6%	89%	2.17	0.411410726	4
6	Bank of Baroda	71%	6%	65%	1.75	0.371062675	3
7	TVS motor company ltd	487%	6%	480%	4.62	1.040458543	10
8	Ashok Leyland ltd	365%	6%	358%	2.66	1.344337016	12
9	Eicher motors ltd	199%	6%	193%	2.79	0.692477774	6
10	Britannia industries ltd	236%	6%	229%	1.49	1.536663886	13
11	Marico ltd	119%	6%	113%	1.50	0.754540884	8
12	Tata consumer products ltd	273%	6%	266%	2.78	0.958768561	9
13	Aurobindo pharma ltd	246%	6%	239%	3.37	0.71039173	7
14	Biocon ltd	25%	6%	19%	-1.75	-0.108398943	1
15	Abbott India ltd	349%	6%	342%	1.51	2.262299728	14

VIII. FINDINGS

In this study, we explored the dynamics of risk and return in five distinct sectors: Information Technology, Banking, Pharmaceutical, Automobile, and Fast-Moving Consumer Goods (FMCG). Our analysis involved constructing two portfolios—Balanced Market Portfolio and Aggressive Growth Portfolio—while considering the past ten years of historical data for each sector.

A. Balanced Market Portfolio

In our pursuit to construct a Balanced Market Portfolio, we meticulously selected 15 stocks from five diverse sectors: Information Technology, Banking, Pharmaceutical, Automobile, and Fast-Moving Consumer Goods (FMCG). This portfolio aimed to strike an equilibrium between risk and return, catering to investors who sought both stability and growth. The following comprehensive insights emerged from our analysis:

1) *Risk-Return Dynamics:* Our research highlighted the compelling interplay between risk and return. Stocks with higher betas exhibited the expected trend of offering higher returns, underscoring the principle of risk-reward trade-off. Notably, INFOSYS LTD and TATA CONSULTANCY SERVICES LTD, with betas of 1.12 and 1.13 respectively, showcased substantial returns that far exceeded the risk-free rate. This phenomenon underscores the potential for investors to achieve healthy returns even within relatively low-beta stocks.
2) *Beta as a Market Indicator:* The inclusion of AXIS BANK LTD in this portfolio provided an intriguing insight. With a negative beta of -0.69, the stock's performance appeared to deviate from the general market trend. This could signify that AXIS BANK LTD's performance was inversely correlated to the broader market, suggesting it might act as a hedge during market downturns.
3) *Strategic Growth Choices:* Our analysis unveiled the strategic choices made by certain companies, such as ABBOTT INDIA LTD. Displaying a beta of 1.51 and remarkable returns of 349%, ABBOTT INDIA LTD demonstrated the benefits of pursuing higher-risk growth strategies. This highlights how companies willing to undertake higher risk might have the potential to reward investors with substantial returns.

B. Aggressive Growth Portfolio

The Aggressive Growth Portfolio was curated with a focus on achieving exceptional returns by embracing higher-risk stocks with elevated betas. This approach catered to investors who were comfortable with volatility in pursuit of potential high rewards. Our meticulous analysis of this portfolio yielded the following profound findings:

1) *High Beta Amplification:* The stocks within the Aggressive Growth Portfolio displayed an amplified response to market fluctuations due to their high beta values. Stocks like TVS MOTOR COMPANY LTD, characterized by a remarkably high beta of 4.62, showcased substantial return volatility. While this elevated beta contributed to impressive returns, it also underlined the importance of risk management in high-beta investments.
2) *Strategic Growth Alignment:* The selection of stocks like BIRLASOFT LTD, with a beta of 2.76 and returns of 321%, emphasized the alignment between high beta and strategic growth orientation. Such companies may have adopted aggressive expansion strategies, translating into remarkable returns while simultaneously subjecting investors to amplified risks.
3) *Investor Profile Match:* The Aggressive Growth Portfolio catered to investors who prioritized returns over stability, and who had a higher risk tolerance. This portfolio structure suited individuals who were willing to weather substantial fluctuations in pursuit of the potential for substantial gains.

IX. CONCLUSION

This research investigated the interplay between risk and return across diverse sectors through the analysis of Balanced Market and Aggressive Growth Portfolios. The findings revealed that stocks with higher betas generally exhibited greater volatility but had the potential for higher returns.

Conversely, stocks with lower betas presented more stable returns but with relatively lower risks. The study highlights the importance of aligning portfolio construction with investors' risk tolerance and investment goals. The Balanced Market Portfolio offered a mix of stable and growth-oriented stocks, suitable for risk-averse investors seeking moderate returns. In contrast, the Aggressive Growth Portfolio targeted investors willing to take on higher risks for the prospect of substantial returns.

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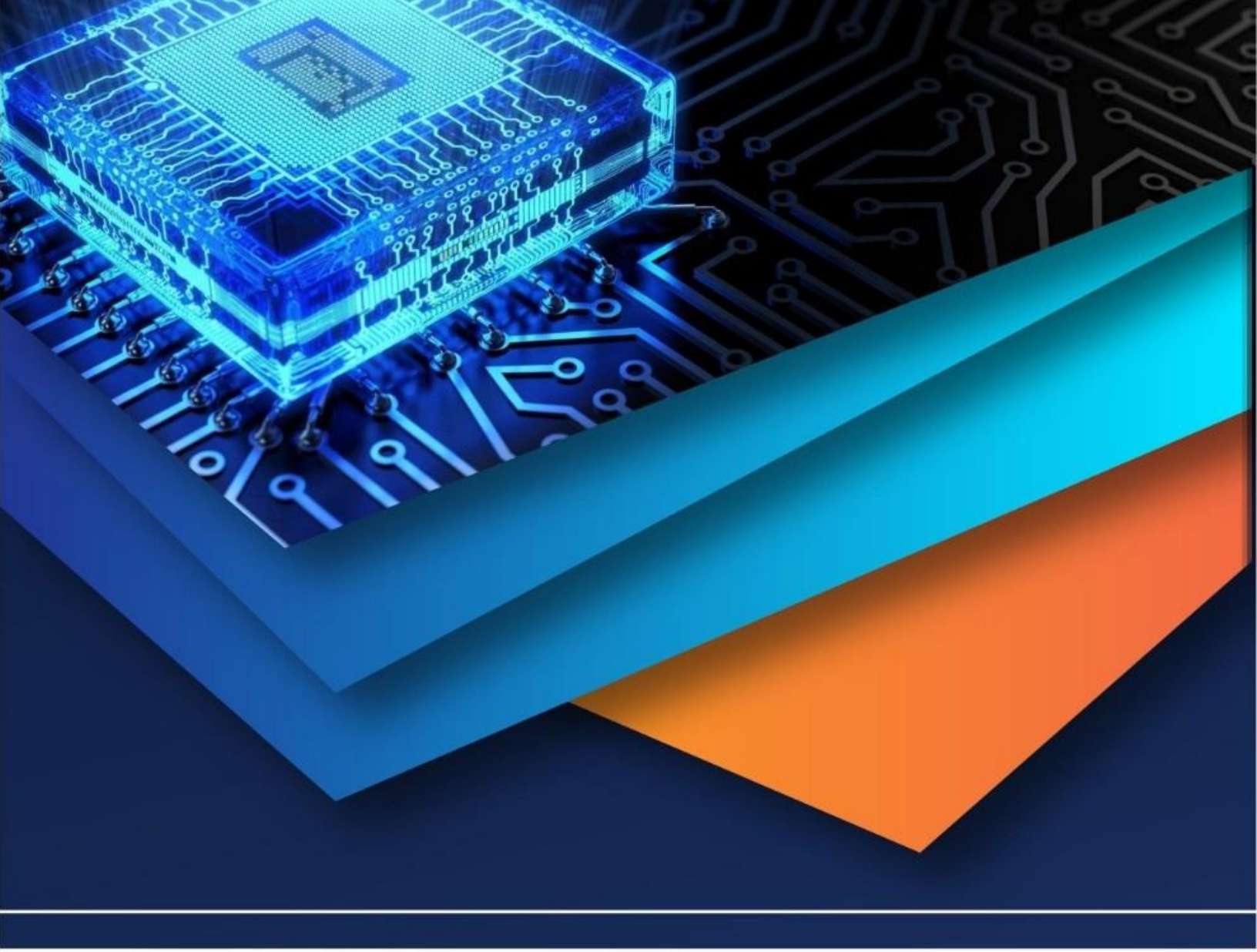

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