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SECTOR-WISE FINANCIAL PERFORMANCE ANALYSIS OF MULTINATIONAL CORPORATIONS LISTED ON THE DHAKA STOCK EXCHANGE

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Abstract: This study explores the financial performance of multinational companies listed on the Dhaka Stock Exchange (DSE) using key financial ratios such as Price-to-Earnings (P/E), Price-to-Book (P/B), Dividend Payout Ratio (DPR), and Return on Equity (ROE). It aims to determine whether these companies present better investment opportunities than their domestic counterparts. This study also examines the trend of stock prices during the same period to determine the relationship between these financial ratios and stock price growth. The research uses secondary data collected from the companies' annual and quarterly financial statements and some websites. Specifically, the study involves benchmarking both international and domestic players in the telecommunications, pharmaceutical, cement, food, and allied sectors. The analysis explores that despite having relatively higher P/E and P/B ratios, meaning that the stocks are overpriced, the multinational companies have better dividend payout ratios, ROE, and stock growth than domestic companies. The findings of this paper also reveal that investors on the DSE frequently invest without considering conventional financial ratios, a practice referred to as emotional investing. This research offers valuable insights for investors and fund managers into the factors influencing investment decisions on the Dhaka Stock Exchange, emphasizing the potential benefits of considering multinational companies as viable investment opportunities. This study provides a comprehensive assessment of multinational companies' financial performance on the DSE, contributing to the understanding of investment dynamics in emerging markets.
Keywords: Financial indicators; Multinational companies (MNCs); Dhaka Stock Exchange (DSE); Price-to-Earnings (P/E); Price-to-Book (P/B); Dividend Payout Ratio (DPR)

1 INTRODUCTION

1.1 Background of the Study

Bangladesh is a developing country with a growing economy. It is recognized as one of the greatest untapped growth markets in Asia [1]. As a result, it is attracting many multinational companies to expand their business here. Currently, more than 45 multinational companies are operating in Bangladesh, which has a high impact on the market [2]. Among these MNCs, thirteen are enlisted in the Dhaka Stock Exchange. These are Bata, British American Tobacco, Singer, Grameenphone, Robi, Reckitt Benckiser, Linde, Marico, GlaxoSmithKline, Heidelberg Cement, Lafarge Holcim, RAK ceramics, and Berger Paints [3]. They are performing consistently in Bangladesh's market.
Bata Shoe has been operating in Bangladesh for over fifty years. It is currently the market leader in the shoe industry, with almost sixty percent market share. Its annual shoe sale currently stands at about thirty million pairs [4]. British American Tobacco is the world's most international business, with brands sold in more than 200 countries [5]. It started operating in Dhaka over a hundred years ago, in 1910. It is the current market leader in the tobacco industry [6]. Its stock is the highest-priced stock on the Dhaka Stock Exchange. Grameenphone is the market leader in the telecommunication industry. It has the highest market value in DSE [7]. Reckitt Benckiser is the leader of toilet care products. Linde BD started its business in Bangladesh in 1950. It is the leading industrial gas provider in Bangladesh [8]. Marico is the leader in the hair care product products category. One of its brands, Parachute, has over eighty percent market share in this category [9]. GSK leads the health food drink sector with over ninety percent market share [10]. Lafarge Holcim has the second-highest market share in the cement industry. However, Heidelberg Cement has made the most profit among the listed companies in the cement industry [11]. Berger Paints Bangladesh has been awarded as the best paint brand in Bangladesh for six years in a row. It is the market leader in the paint industry with over forty-eight percent market share [12].
They also perform at a high level in DSE. Five of these thirteen are in the DS30 index, which is the index of the best 30 companies of DSE. This indicates they are successful in the share market as well [13]. Because of their stable performance, investors consider them safe investments, and fund managers consider them smart investments. They are among the highest-priced stocks of DSE and also among the highest dividend providers.
This study aims to explore the Financial Indicators of the multinational companies in the Dhaka Stock Exchange from different sectors. This study will be of good use to the value investors [14]. Mutual fund management companies like the researcher's employee organization VIPB AMCL could use it as a reference when making investment decisions [15]. Also, it will give new insight into the performance of multinational companies in DSE. The findings of this study can

work as an encouraging factor for other multinational companies to join the capital market. Also, by comparing the growth of the stocks with the ratios, this study will indicate if the market cares about the ratios and if the stocks with better ratios are growing better.

1.2 Objective of the Study

1.2.1 Broad objective

The broad objective of the study is to analyses financial indicators of the multinational companies that are being traded in Dhaka Stock Exchange and to find out if they are better for investment than other companies in Dhaka Stock Exchange.

1.2.2 Specific objectives

The specific objective of this study can be stated as:

- To do a sector wise comparison of P/E ratio, P/B ratio, dividend payout ratio, and return on equity of multi-national companies of Dhaka Stock Exchange with other companies of the same sector.
- To do a sector wise comparison of the growth of the multinational company's stock price and to find out if there is any relation between growth and ratios

2 LITERATURE REVIEW

An organization's financial performance is critical for determining its profitability level, risk tolerance, and health, especially in active markets such as the Dhaka Stock Exchange (DSE) [16]. DSE has registered Global Funds with varying dimensionality, and therefore, a sector-wise analysis of money flow trends, correlations, investment decision-making, etc., is highly recommended [17]. This study seeks to examine a few selected financial ratios – price-earnings ratio (P/E), price-to-book value ratio (P/B), dividend payout ratio, and return on equity (ROE) – that are most strongly associated with how the entity is perceived and more significantly, investors' actions regarding the entity [18].

Analyzing ratios or cross-sectional ratios is an essential technique when evaluating a company's financial position [19]. Ratios can be used to forecast financial statements, assess improvements through time, and assess the overall health of an organization [20]. The analysis is intended for a variety of audiences, including investors and lenders, for whom it is particularly useful in aiding their decisions about the provision of credit [21]. Ratios tell a story. Therefore, companies can develop ratio measures over time to be better able to make decisions [22].

Historically, the price-earnings ratio has been a subject of study since time immemorial, and there could be excess profits from conducting a valuation of a company as far back as 1934 [23]. Several studies found that stocks with low price-earnings and price-book ratios are more profitable [24]. A portfolio with a low P/E has earned significant excess returns over a portfolio with a high P/E, as illustrated by the Magnet example [25]. Portfolios with PE multiples below ten generated a return of 131%, while portfolios with PE multiples above twenty generated a return of 71% [26]. Now, different digital AI platforms are used in different industries to find the result of various ratios as well [27,28].

The so-called P/E effect was the result of some biases, such as survivorship and look-ahead biases [29]. Researchers found that the biases affect the P/E ratios and return significantly, but when the biases are removed, there is no correlation between the two [30]. Stock returns explain P/E ratios as low P/E stocks gained 10-11% over high P/E supportive stocks. P/E ratios play a significant role in the decision-making process [31].

The price-to-book ratio is the second most important measure of a company's value, after the price-to-earnings ratio, because it indicates the relationship between a firm's book value and its market value [32]. Growth investors seeking reasonable prices (GARP) are likely to have a lower P/B ratio since such firms are viewed as trading at lower values but have better prospects [33]. P/B ratios can be incorporated with excess returns resulting from better performance to measure productivity levels [34].

In contrast, only earning power and business risk determine a firm's value [35] without taking into consideration dividend policy which is a reason for doubting the relevance of dividends [36]. However, some study reached opposite conclusions regarding the effect of dividends on firm value in relation to shareholders [37]. Market prices are dependent on dividends in the present as well as in the future, and high levels of dividend retention are likely to support superior growth in the future [38].

Return on equity (ROE), an indicator of how efficiently a company converts shareholder investments into profits, is an important performance measure for investors [39]. This ratio ensures that management can translate business expansion into non-equity capital [40]. The factors responsible for the success of growth-oriented stocks found that the best-performing growth stocks had ROEs of not less than 17%, while the leading firms had ROEs of 25%-50% [41].

3 METHODOLOGY OF THE STUDY

3.1 Research Design

This research is conducted using secondary data collected from the financial statements of the companies as well as from various websites. Also, it is based on previous works on similar topics. So, it is secondary research.

3.2 Sampling

All the multinational companies in the Dhaka Stock Exchange have been selected for this analysis. The whole population is part of the analysis. The companies are addressed in this study using their ticker name in DSE. The ticker names are as followed: BATASHOE- Bata Bangladesh, BATBC- British American Tobacco Bangladesh Company, LHBL- Lafarge Holcim Bangladesh Limited, HEIDELBCEM- Heidelberg Cement Bangladesh, SINGERBD- Singer Bangladesh, GLAXOSMITH- GlaxoSmithKline, BERGERPBL- Berger Paints Bangladesh Limited, MARICO- Marico Bangladesh, RECKITTBEN- Reckitt Benckiser Bangladesh, GP- Grameenphone, LINDEBD- Linde Bangladesh.
To select companies other than multinational companies from the sectors, a judgmental sampling technique has been used [43]. Companies with higher market values have been selected. Ten companies including the multinational company/companies have been selected from the food & allied, fuel & power, engineering, pharmaceuticals & chemicals, and miscellaneous sector [44]. The telecommunication, tannery industry, and cement industry sectors have only two, six, and seven companies listed in DSE. So, all of them have been selected for analysis [45].

3.3 Data Analysis Methods Adopted

3.3.1 P/E ratio

P/E is the ratio of the market price of a company's stock to its earnings. It gives the amount of money investors pay to earn a unit [46].

$$P/\text{E} = Market\ Value\ Per\ Share/\text{EPS} \tag{1}$$

$$Earnings\ Per\ Share\ (EPS) = (Income - Dividends\ on\ Preferred\ Stocks/\ Net\ Average\ Outstanding\ Shares)$$

Lower P/E ratios are better than higher P/E ratios. So, companies will be ranked from lowest to highest. For decision making, suggestions made by Nicholson's study will be used:

- <10% - Low, Very Good
- 10%-20% - Good
- 20%-30% - High, Okay
- >30% - Very High, Bad/

3.3.2 P/B ratio

The Price to Book Ratio - P/B Ratio is used to compare a firm's market to book value and is calculated by dividing price per share by book value per share [47].

$$P/\text{B} = Market\ Price\ Per\ Share/\ Book\ Value\ Per\ Share$$
$$Book\ Value\ Per\ Share = (Total\ Assets - Total\ Liabilities)/Number\ of\ Shares \tag{2}$$

Lower P/B ratios are better than higher ones. Companies will be ranked from lowest to highest. For decision making, the following scale will be used:

- <1.0 – Low, Good, potentially undervalued stock
- 1.0-3.0 – Okay, Considerable to value investor
- >3.0 – High, potentially overvalued stock

3.3.3 Dividend payout ratio

The dividend payout ratio is the ratio of the total amount of dividends paid out to shareholders relative to the net income of the company. It is the percentage of earnings paid to shareholders in dividend
Higher dividend payout ratios are better for investors. Companies will be ranked from highest to lowest. For decision making, dividend payout brackets proposed by Ani G will be used which is as below:

- <0% - Loss making
- 0%-35% - Good
- 35%-55% - Healthy
- 55%-75% - High
- 75%-95% - Very High
- 95%- 150% - Unsustainable
- >150% - Very Unsustainable

3.3.4 Growth of stock

Growth of stock indicates how much the stock's price has increased over time. In this study growth percentage will be measured [48].

$$Percetage\ of\ Growth = (Current\ Price - Previous\ Price)/\ Previous\ Price \times 100 \tag{3}$$

3.3.5 Return on equity

Return on equity (ROE) is a measure of the profitability of a business in relation to the book value of shareholder equity. ROE is a true bottom-line profitability metric, comparing the profit available to shareholders to the capital provided or owned by shareholders [47].

$$ROE = Net\ Income/Average\ Shareholders\ Equity \quad (4)$$

Higher return on equity is better than lower ones. So, stocks will be ranked from highest to lowest. In 2017, data compiled by New York University finance professor Aswath Damodaran showed that the average ROE of more than 7,400 US publicly traded firms was 10.38%. So, anything higher than that is good. Based on his study and research done by Investor's Business Daily, the following scale will be used [49]:

- <10% - Low
- 10%-17% - Above Average
- 17%-25% - Good, Potential Growth Stock
- 25%-50% - Good, Potential Winner Stock
- >50% - High

4 ANALYSIS AND FINDINGS

4.1 Cement Industry

Table 1 Data Analysis of Cement Industry's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
CONFIDCEM	13.95	1	2.19	4	13.55%	6	14.03%	2	34.97%	3
PREMIERCEM	14.35	2	1.71	1	38.68%	5	12.56%	3		
MICEMENT	18.31	3	1.71	1	44.94%	4	9.57%	4	-0.37%	4
HEIDELBCEM	25.22	4	4.31	7	105.56%	2	15.61%	1	35.96%	2
MEGHNACEM	33.33	5	2.67	5	68.73%	3	8.08%	5	-12.53%	5
LHBL	82.90	6	4.19	6	144.93%	1	5.26%	6	60.67%	1
ARAMITCEM	n/a	7	2.06	3	0.00%	7	-22.74%	7	-70.75%	6

Source: Analysis of data collected from annual reports and DSE website

Heidelberg Cement has the fourth lowest p/e ratio in its sector while Lafarge Holcim Bangladesh is ranked sixth in p/e ratio rank (Table 1). Heidelberg Cement's p/e ratio is less than 30, so it is not high. But with a p/e ratio of 82.9, Lafarge Holcim has a very high p/e ratio. So, investors are paying a lot more for a share than the share earns. In the case of the p/b ratio, these two multinational companies have the worst p/b ratios in their sector. Both companies' p/b ratio is over 3. Their p/b ratios are high, and these stocks are potentially overvalued.

The scenario is completely different in terms of dividend payout ratio and percentage of growth. Lafarge Holcim holds the top position in both categories while Heidelberg Cement holds the second place [50]. Both these companies' dividend payout ratio is in the unsustainable area, they are giving away more as dividend than their earning. As for the growth, Lafarge Holcim has grown by almost eighteen percent while Heidelberg Cement has grown slightly.

Heidelberg Cement has the highest return on equity in the cement sector. Its ROE is above average. Lafarge Holcim's return in equity is not so good. With low ROE, it is in second from bottom

4.2 Tannery Industry

Tannery industry has six participants in the DSE. Bata is the only multinational company in this sector. This industry's companies' ratios are as below (Table 2):

Table 2 Data Analysis of Tannery Industry's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
BATASHOE	13.71	1	3.65	5	40.68%	3	29.45%	1	114.50%	3
FORTUNE	16.65	2	2.47	3	0.00%	4	14.88%	2		6
APEXFOOT	45.61	3	1.45	1	68.59%	2	-0.48%	5	42.15%	5
APEXTANRY	48.95	4	1.98	2	135.59%	1	3.99%	4	79.60%	4
LEGACYFOOT	108.56	5	5.27	6	0.00%	4	5.99%	3	476.56%	1
SAMATALETH	n/a	6	3.41	4	0.00%	4	-1.01%	6	253.33%	2

Source: Analysis of data collected from annual reports and DSE website

Bata Shoe has the lowest p/e ratio in the tannery industry. Its p/e ratio is good. But opposite scenario can be seen for its p/b ratio. With a p/b ratio of 3.65, which is higher than three, it is ranked fifth out of the eight companies. Bata has the highest return on equity in this sector. Its ROE is very good, and it indicates that Bata's stock could be a winner in future.

As for the dividend payout ratio and percentage of capital appreciation, it is ranked third in both case [51]. It has a healthy dividend payout ratio. Its share price has gone up by over one hundred percent since January 2013. It is a growth stock.

4.3 Telecommunication Industry

Table 3 Data Analysis of Telecommunication Sector's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
GP	19.09	1	14.91	2	100.94%	1	79.84%	1	130.29%	1
BSCCL	51.50	2	2.69	1	62.18%	2	5.30%	2	-23.77%	2

Source: Analysis of data collected from annual reports and DSE website

There are only two companies listed in DSE from telecommunication industry (Table 3). Grameenphone is ranked top in all but p/b ratios rank. Its p/e ratio is good. But its p/b ratio is very high. The same is true for dividend payout ratio and return on equity. It has a payout ratio of just over hundred percent, which is in the unstable zone. Its return on equity is quite high as well. Grameenphone's stock price has grown quite a lot since January 2013. It has more than doubled, so it can be called a growth stock [52].

4.4 Food & Allied Sector

Table 4 Data Analysis of Food & Allied Sector's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
EMERALDOIL	3.48	1	0.72	1	0.00%	3	20.78%	3		
GHAIL	20.00	2	1.9	5	0.00%	3	8.70%	5		
BATBC	25.83	3	8.84	8	45.98%	2	37.29%	1	276.56%	2
OLYMPIC	26.95	4	8.23	7	54.74%	1	33.05%	2	138.43%	3
FUWANGFOOD	27.25	5	1.72	4	0.00%	3	5.77%	7	-25.40%	6
RDFOOD	28.31	6	1.09	2	0.00%	3	3.60%	8	-39.05%	7
FINEFOODS	54.31	7	3.23	6	0.00%	3	5.87%	6	96.11%	5
MEGCONMILK	n/a	8	n/a	10	0.00%	3	20.09%	4	136.84%	4
BEACHHATCH	n/a	9	1.15	3	0.00%	3	-3.48%	9	-49.19%	8
RAHIMAFOOD	n/a	10	60.43	9	0.00%	3	-6.86%	10	876.57%	1

Source: Analysis of data collected from annual reports and DSE website

British American Tobacco Bangladesh Company has p/e ratio of just over twenty-five, which is okay (Table 4). But its p/b ratio is very high. It has one of the worst p/b ratios in its sector. But it has the highest return on equity in its sector. Its ROE is within the range of 25%-50%, so it is potentially a winner.
BATBC is ranked second in both dividend payout ratio and growth percentage. It has a healthy dividend payout ratio. It has grown over two hundred and seventy-five percent in the last five so years. It indicates that it is a growth stock [53].

4.5 Fuel & Power Sector

Among the 19 companies listed in DSE from the fuel & power sector, Linde BD is the only multinational company. The selected ten companies' ratios are as below (Table 5):

Table 5 Data Analysis of Fuel & Power Sector's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
TITASGAS	7.56	1	0.59	2	42.97%	7	7.99%	8	-41.72%	7
SUMITPOWER	10.13	2	1.34	5	79.79%	3	24.33%	3	-27.43%	6
BARKAPOWER	10.72	3	1.31	4	19.01%	10	17.45%	7	-13.50%	5
POWERGRID	10.92	4	0.52	1	34.64%	8	5.20%	9	-10.59%	4
KPCL	13.59	5	2.69	6	108.48%	2	19.94%	5	39.76%	2
MJLLBD	14.69	6	2.92	8	65.12%	5	21.48%	4	18.85%	3
SPCL	15.45	7	2.77	7	25.48%	9	19.51%	6		
LINDEBD	19.78	8	5.13	9	54.31%	6	27.77%	2	131.35%	1
UPGDCL	25.94	9	8.17	10	78.26%	4	30.50%	1		
DESCO	95.91	10	1.14	3	227.27%	1	1.18%	10	-42.82%	8

Source: Analysis of data collected from annual reports and DSE website

Linde Bangladesh is ranked eighth in the p/e ratios rank and ranked ninth in p/b ratio's rank. But the average p/e ratio of the fuel and power sector is low. As a result, despite ranking so low, Linde BD's p/e ratio is good. But its p/b ratio is very high. It is in the middle in the dividend payout ratio's rank. Its dividend payout ratio is healthy. Linde's return on

equity is also very good. With a ROE of 27.77%, it is ranked behind Uniter Power Generation & Distribution Company Ltd. Linde has grown by over one hundred percent since January 2013. It is the best in its sector.

4.6 Pharmaceuticals and Chemicals Sector (Table 6)

Table 6 Data Analysis of Pharmaceuticals & Chemicals Sector's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
KEYACOSMET	4.13	1	0.66	2	0.00%	9	13.96%	6	-72.96%	8
ACTIVEFINE	8.70	2	1.51	6	0.00%	9	14.16%	5	-60.19%	7
ORIONPHARM	12.26	3	0.62	1	44.12%	6	5.54%	9		
ACMELAB	14.24	4	1.17	3	52.95%	5	8.24%	8		
BXPHARMA	16.87	5	1.48	5	22.77%	7	8.88%	7	56.68%	5
SQURPHARMA	18.39	6	4.28	7	22.57%	8	23.74%	4	64.86%	4
RECKITTBEN	22.29	7	39.79	10	97.98%	4	125.27%	1	139.28%	3
MARICO	25.25	8	23.02	9	109.36%	2	87.58%	2	178.19%	1
GLAXOSMITH	25.48	9	6.43	8	98.99%	3	24.93%	3	158.21%	2
BEACONPHAR	40.44	10	1.39	4	111.11%	1	2.08%	10	16.67%	6

Source: Analysis of data collected from annual reports and DSE website

4.7 Engineering Sector

The three multinational companies in the pharmaceuticals and chemicals industry ranked poorly in the p/e, and p/b ratio's rank. They have the three highest p/b ratios in this sector, while only Beacon Pharma has higher p/e ratio than these three companies. All these three MNCs have p/e ratio between twenty and thirty, which is okay but not good. But their p/b ratio is very high. Especially Marico, and Reckitt Benckiser's p/b ratio is very high compared to the other companies in the sector. But for the other two ratios, and growth percentage, the scenario is completely different.

Reckitt Benckiser, Marico, and GlaxoSmithKline holds the top three positions in return on equity as well as growth percentage's rank. They also hold three out of top four ranks in the dividend payout ratio's ranking. Marico has a very high dividend payout ratio which can be described as unsustainable. Its return on equity is very high as well. Its price has doubled and grown some in the study period. So, it can be described as a growth stock. Reckitt Benckiser also has an unsustainable dividend payout ratio and very high return on equity. Its stock price has increased by almost 140% in the same period. GlaxoSmithKline also has an unsustainable dividend payout ratio like the other two. But it has a good return on equity ratio which indicates a potentially growth in stock. Its price has also increased greatly in this period. Like the other two in this sector, it is also a growth stock according to its growth percentage (Table 7).

Table 7 Data Analysis of Engineering Sector's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
APOLOISPAT	9.19	1	0.61	2	0.00%	8	6.23%	9		
BBS	10.79	2	2.11	6	17.12%	6	19.91%	2		
OAL	12.99	3	1.10	4	0.00%	8	8.18%	6		
BSRMSTEEL	14.50	4	2.12	7	70.28%	2	15.34%	4	6.33%	2
WMSHIPYARD	14.63	5	1.00	3	14.02%	7	6.45%	8		
IFADAUTOS	16.47	6	4.21	9	31.16%	3	17.46%	3		
SINGERBD	18.84	7	6.30	10	102.15%	1	35.78%	1	13.41%	1
GPHISPAT	20.38	8	2.41	8	27.32%	4	11.59%	5	-23.25%	3
BSRMLTD	25.15	9	1.93	5	25.77%	5	7.14%	7		
GOLDENSON	n/a	10	0.44	1	0.00%	8	-5.33%	10	-80.94%	4

Source: Analysis of data collected from annual reports and DSE website

Singer Bangladesh has a good p/e ratio. But still it is ranked seventh in the p/e ratios rank. These sector's p/e ratios are good. Singers have the highest p/b ratio in their sector. Its p/b ratio is not good. But in the other three categories, it holds the top position.

Singer's dividend payout ratio is over one hundred percent. So, it is giving more dividend than their earning. This ratio is unsustainable. Its return on equity is very good. This ratio indicates it can be a winner stock. Their stock price has increased by just over thirteen percent in the study period. Most of the stocks in this sector was listed after January 2013.

4.8 Miscellaneous

Table 8 Data Analysis of Miscellaneous Sector's Companies

Name	P/E	Rank	P/B	Rank	DPR	Rank	ROE	Rank	% Growth	Rank
AMANFEED	12.42	1	1.73	7	44.05%	5	13.95%	2		
NFML	12.88	2	1.16	4	0.00%	7	8.31%	3		

BERGERPBL	17.08	3	11.47	9	77.82%	2	45.26%	1	157.02%	2
KBPPWBIL	20.62	4	1.42	6	0.00%	7	6.39%	4		
BEXIMCO	20.70	5	0.36	1	38.76%	6	1.71%	7	-58.92%	6
MIRACLEIND	37.20	6	1.16	4	0.00%	7	2.91%	6	252.27%	1
SINOBANGLA	38.36	7	2.39	8	62.89%	3	6.24%	5	123.44%	3
GQBALLPEN	64.34	8	0.68	2	60.24%	4	0.94%	8	-33.83%	5
BSC	67.74	9	0.77	3	161.29%	1	0.81%	9	-84.56%	7
USMANIAGL	n/a	10	17.14	10	0.00%	7	-43.04%	10	76.03%	4

Source: Analysis of data collected from annual reports and DSE website

As this is the miscellaneous sector (Table 8), the companies in this sector are versatile. But Berger Paints Bangladesh's performance is good comparing to the other companies in this versatile sector. Its P/E ratio is good. But its P/B ratio is very high. A P/B ratio of 11.47 is not at all desirable to investor. As for the dividend payout ratio of 77.82%, it is very high. It has the best return on equity in its sector and it is a good one as well. Its growth is also very good, which indicates it is a growth stock.

5 DISCUSSION

The ratios and growth percentage give mixed signals about the performance of multinational companies in DSE. They are mostly ranked in the bottom half in the p/e and p/b ratios rank [54]. However, they hold the top places in the dividend payout ratio, return on equity, and growth percentage rank. Though the multinational companies have comparatively higher p/e ratios than the other companies in their sector, their p/e ratios are not bad [55]. Only Lafarge Holcim has a high p/e ratio. Five of them have a good p/e ratio, and five of them have an okay p/e ratio [56]. While in all sectors but one, they have the leading rank in dividend payout ratio, return on equity, and growth rank. In the cement industry, the company with the best p/e ratio is ranked three in the growth rank, while the one ranked last has seen the best growth [57]. The companies with better p/b ratios are ranked in lower positions, while the worst two ratio holders have seen the best growth.

The scenario is similar in the tannery industry as well [58]. The companies with the worst p/e ratios have seen the best growth. However, other than that, there is no pattern. No similarities can be seen between the other ratios [59]. Only two companies are in the telecommunication industry, and GP holds the best position in all but the p/b ratio's rank. In the food and allied sector, Rahima Food is ranked tenth and ninth in the p/e and p/b ratio rank, but it has seen the most growth [60]. However, the best ratio holders do not have the worst rank. So, no significant relation in there as well.

In the fuel and power industry, no visible pattern can be found [61]. No relation can be seen between ratios and growth. The same is true for the pharmaceuticals and chemicals industry. The engineering sector is also similar [62]. The worst p/e ratio holder has the worst roe and is in fourth place of growth, while the best p/e ratio holder has the second worst ROE [63]. The miscellaneous sector consists of all the companies that do not belong to any other sector. As expected, no pattern is visible in this sector as well. Throughout this study, no clear relationship has been found in analyzing the ranks [64]. Previous studies have indicated that the Dhaka Stock Exchange needs to operate rationally. It could be more effective. Rather, the investors here invest based on their emotions and judgment, and the investment pattern follows a random walk pattern. This study also finds similar results. This study indicates that investors do not invest based on ratios due to proper knowledge and lack of training [65]. The market does not operate rationally; investors invest based on their emotions rather than based on the company's performance.

6 CONCLUSION

The four ratios used in this study indicate the performance of a stock from various angles. P/E ratio compares the price to earnings, P/B ratio compares price to book value of equity. Dividend payout ratio indicates how much of its income is the companies paying out as dividend. Return on equity gives an idea about how effectively equity holders' investments are used by the company. Previous studies have found that the low P/E and P/B ratio is good for the company as well as the investors, while high dividend payout ratio and return on equity are better. Using their study as benchmark, this study has found that most multinational companies' performance can be described as okay or bad if we consider only the p/e, and p/b ratio but it can be described as good when dividend payout ratio or return on equity is considered. But the main indicator for investors would be how they have grown in the last few years. And this study shows that they have grown quite a lot. Most of them can be described as growth stock. The three indicators, dividend payout ratio, return on equity, and growth leads to the conclusion that multinational companies can be described as smart investment. The value investors are right to consider these stocks as smart investment. As for the market, DSE is not an efficient market according to this study. Ratios do not have significant impact on growth.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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SHORT-TERM AND LONG-TERM PRODUCT DEMAND FORECASTING WITH TIME SERIES MODELS

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Abstract: This study explores the effectiveness of various time series models for short-term and long-term product demand forecasting, emphasizing the importance of accurate predictions in business operations. Demand forecasting is crucial for optimizing inventory levels, enhancing operational efficiency, and ensuring customer satisfaction. The paper categorizes forecasting into two primary types: short-term, which focuses on immediate operational needs, and long-term, which is essential for strategic planning and resource allocation. The analysis employs a rich dataset of historical sales data from a retail company, encompassing various influencing factors such as seasonal fluctuations and promotional impacts. The methodology includes data preprocessing steps to ensure data integrity, followed by the implementation of various time series models, including Moving Averages, Exponential Smoothing, ARIMA, Seasonal Decomposition of Time Series, Long-Term ARIMA, and SARIMA. The study also incorporates machine learning approaches to enhance forecasting accuracy. Evaluation metrics such as Mean Absolute Error, Mean Squared Error, Root Mean Squared Error, and Mean Absolute Percentage Error are utilized to assess model performance. The comparative analysis reveals that while traditional time series models are effective for short-term forecasting, advanced techniques like machine learning can significantly improve long-term predictions. The findings highlight the need for tailored modeling strategies based on specific business objectives and the importance of integrating external factors into forecasting models.
Overall, this research contributes to the ongoing discourse in demand forecasting by identifying gaps in existing literature and suggesting areas for further exploration, such as the integration of short-term and long-term approaches and the incorporation of advanced techniques like AI and big data analytics.
Keywords: Demand forecasting; Time series models; Machine learning

1 INTRODUCTION

Product demand forecasting is a critical aspect of business operations, enabling companies to anticipate customer needs, optimize inventory levels, and enhance overall operational efficiency. At its core, demand forecasting involves predicting future customer demand for products or services based on historical data and various influencing factors[1]. Accurate demand forecasts are essential for effective supply chain management, production planning, and financial forecasting. Businesses that can accurately predict demand are better positioned to minimize costs, reduce stockouts, and improve customer satisfaction.
Demand forecasting can be categorized into two primary types: short-term and long-term forecasting[2]. Short-term forecasting typically focuses on predicting demand over a period ranging from a few days to several months. This type of forecasting is crucial for day-to-day operations, inventory management, and immediate supply chain decisions. Conversely, long-term forecasting extends over a longer horizon, often spanning several months to years. It is essential for strategic planning, capacity planning, and resource allocation[3]. The distinction between these two types of forecasting lies not only in the time frame but also in the methods, models, and data used to generate accurate predictions.
Time series models play a significant role in both short-term and long-term demand forecasting. Time series data consists of observations collected sequentially over time, allowing analysts to identify patterns, trends, and seasonal variations[4]. The relevance of time series analysis in demand forecasting is underscored by its ability to capture temporal dependencies and provide insights into future demand based on historical performance. However, demand forecasting is not without its challenges[5]. Factors such as changing consumer preferences, economic fluctuations, and unforeseen events can complicate the forecasting process, leading to inaccuracies and potential financial losses.
The objectives of this paper are twofold. First, it aims to analyze the effectiveness of various time series models for short-term and long-term forecasting. By examining different modeling approaches, the paper seeks to identify which models provide the most accurate predictions for specific forecasting horizons[6]. Second, the paper will compare the accuracy and applicability of these models in real-world scenarios, highlighting their strengths and limitations. This analysis will contribute to a deeper understanding of how businesses can leverage time series forecasting to enhance decision-making and operational performance[7].
The structure of the paper is organized as follows. After the introduction, a literature review will present an overview of demand forecasting techniques, including traditional and advanced methods[8]. It will also explore the key concepts of time series analysis and the distinctions between short-term and long-term forecasting. The literature review will conclude by identifying gaps in the current research, emphasizing the need for further exploration in this area.

2 LITERATURE REVIEW

Demand forecasting techniques have evolved significantly over the years, reflecting advancements in statistical methods, computational power, and data availability. Traditional forecasting methods, such as moving averages and exponential smoothing, have long been staples in the field[9]. Moving averages involve calculating the average of past observations over a specified period, providing a simple yet effective way to smooth out fluctuations and identify trends. Exponential smoothing, on the other hand, assigns exponentially decreasing weights to older observations, allowing for more responsive forecasts that can adapt to recent changes in demand patterns[10]. These methods are particularly useful for short-term forecasting, where quick adjustments to demand shifts are necessary.

In addition to traditional methods, advanced forecasting techniques have emerged, leveraging more sophisticated statistical models and machine learning algorithms[11]. One such technique is the AutoRegressive Integrated Moving Average model, which combines autoregressive and moving average components to capture temporal dependencies in time series data. ARIMA is versatile and can be applied to both stationary and non-stationary data, making it suitable for a wide range of forecasting scenarios[12]. Furthermore, machine learning approaches, such as regression trees, neural networks, and ensemble methods, have gained traction in recent years. These techniques can process large volumes of data and capture complex relationships that traditional models may overlook, thereby enhancing forecasting accuracy[13].

Understanding time series analysis is fundamental to effective demand forecasting. Key concepts in time series analysis include trends, seasonality, and cyclic patterns. Trends refer to long-term movements in the data, indicating a general upward or downward trajectory over time[14]. Seasonality captures regular, predictable fluctuations that occur within specific time intervals, such as increased sales during holiday seasons. Cyclic patterns represent longer-term oscillations that may be influenced by economic cycles or other external factors. By identifying and modeling these components, businesses can create more accurate forecasts that account for inherent variability in demand[15].

The distinction between short-term and long-term forecasting is crucial for understanding the appropriate application of various forecasting techniques[16]. Short-term forecasting typically relies on more reactive models, as it addresses immediate operational needs. In contrast, long-term forecasting requires a more strategic approach, often incorporating broader economic indicators and market trends. Studies comparing short-term and long-term forecasting methods have highlighted the importance of selecting the right model based on the specific forecasting horizon[17]. For instance, while ARIMA models may perform well for short-term predictions, they may not capture long-term trends effectively without adjustments. Conversely, models designed for long-term forecasting may lack the responsiveness required for short-term demand fluctuations[18].

Despite the advancements in demand forecasting techniques, gaps remain in the literature that warrant further investigation. One area that requires attention is the integration of short-term and long-term forecasting approaches. Many businesses operate in dynamic environments where both immediate and strategic forecasting are essential for success. However, existing studies often treat these forecasting horizons in isolation, neglecting the potential benefits of a hybrid approach that leverages the strengths of both methodologies. Additionally, there is a growing need to explore the impact of external factors, such as economic shifts and consumer behavior changes, on forecasting accuracy. Understanding how these factors influence demand can enhance the robustness of forecasting models and improve overall decision-making.

In conclusion, the literature on demand forecasting has evolved to encompass a wide range of techniques, from traditional methods to advanced statistical and machine learning approaches. Time series analysis remains a cornerstone of demand forecasting, providing valuable insights into historical patterns and trends. The distinction between short-term and long-term forecasting underscores the need for tailored modeling strategies that align with specific business objectives. However, significant gaps in the literature highlight the importance of integrating various forecasting horizons and considering external influences on demand. This paper aims to address these gaps by analyzing the effectiveness of time series models for both short-term and long-term forecasting, ultimately contributing to the ongoing discourse in the field of demand forecasting.

3 METHODOLOGY

3.1 Data Collection

The foundation of any robust forecasting model lies in the quality and relevance of the dataset utilized. For this study, we focus on historical sales data from a retail company that operates in a dynamic market environment. The dataset spans several years and includes daily sales figures for various products, encompassing seasonal fluctuations, promotional impacts, and other influencing factors. The dataset is comprehensive, comprising not only sales volumes but also additional relevant attributes such as product categories, pricing information, and promotional events. This rich dataset allows for a nuanced analysis of demand patterns and trends, facilitating more accurate forecasting.

Prior to modeling, several data preprocessing steps are essential to ensure the integrity and usability of the dataset. The first step involves cleaning the data to remove any inconsistencies, such as duplicate entries or erroneous values. This is crucial because even minor errors can significantly skew forecasting results. Next, we address missing values, which are common in historical datasets. Depending on the extent and nature of the missing data, we employ different strategies, such as interpolation for small gaps or using the mean or median for larger gaps. Normalization is another critical

preprocessing step, especially when dealing with features that operate on different scales. In this case, we standardize the sales values to ensure that the models can learn effectively without being biased by the scale of the data. By meticulously preparing the dataset, we lay the groundwork for effective modeling and accurate forecasting outcomes.

3.2 Time Series Models

In this study, we employ a variety of time series models tailored for both short-term and long-term forecasting. For short-term forecasting, we focus on three primary models: Moving Averages, Exponential Smoothing, and ARIMA. Moving Averages is one of the simplest yet effective methods for smoothing out short-term fluctuations and identifying trends in the data. By averaging a set number of past observations, this model helps to mitigate the impact of random noise, making it easier to identify underlying patterns.
Exponential Smoothing takes this a step further by applying weights to past observations, giving more importance to recent data. This method has several variations, including Simple Exponential Smoothing, Holt's Linear Trend Model, and Holt-Winters Seasonal Model. The latter two are particularly useful for capturing trends and seasonal patterns in the data, making them ideal for retail sales forecasting. ARIMA, on the other hand, is a more sophisticated model that combines autoregressive and moving average components, along with differencing to make the time series stationary. This model is particularly effective for datasets that exhibit clear trends and seasonal patterns.
For long-term forecasting, we explore Seasonal Decomposition of Time Series, Long-Term ARIMA, and SARIMA. STL is a powerful technique that decomposes a time series into its seasonal, trend, and residual components, allowing for a more detailed analysis of underlying patterns. Long-Term ARIMA and SARIMA extend the capabilities of traditional ARIMA by incorporating seasonal effects, making them suitable for datasets with pronounced seasonal fluctuations. Additionally, we consider machine learning approaches such as Random Forest and Gradient Boosting, which can capture complex relationships in the data and provide robust long-term forecasts. By leveraging a diverse set of models, we aim to identify the most effective forecasting techniques for both short-term and long-term demand predictions.

3.3 Model Evaluation Metrics

To evaluate the performance of the forecasting models, we utilize several key metrics that provide insights into their accuracy and reliability. The Mean Absolute Error is one of the most straightforward metrics, representing the average absolute difference between predicted and actual values. This metric is particularly useful because it is easy to interpret and provides a clear indication of the average error magnitude.
The Mean Squared Error is another widely used metric that squares the errors before averaging, giving more weight to larger errors. This characteristic makes MSE sensitive to outliers, which can be beneficial in certain contexts where large errors are particularly undesirable. The Root Mean Squared Error is derived from MSE and provides a measure of error in the same units as the original data, making it easier to understand in practical terms.
Lastly, the Mean Absolute Percentage Error expresses the error as a percentage of the actual values, providing a relative measure of accuracy that is especially useful when comparing performance across different datasets or forecasting horizons. By employing these evaluation metrics, we can comprehensively assess the performance of each forecasting model, enabling us to make informed decisions regarding their applicability in real-world scenarios.

4 EXPERIMENT

4.1 Experimental Setup

The experimental framework for this study is designed to systematically evaluate the performance of the selected time series models for both short-term and long-term forecasting. The first step in the experimental setup involves dividing the dataset into training and testing subsets. The training dataset is used to fit the models, while the testing dataset is reserved for evaluating their predictive performance. A common approach is to allocate approximately 70-80% of the data for training and the remaining 20-30% for testing, ensuring that the models are trained on a substantial amount of data while still providing a robust evaluation as in table 1.

Table 1 Data Used in the Study

Variable	Type	Description
Value	Numeric	Demand Quantity

The tools and software used for analysis include Python and R, both of which offer extensive libraries and packages for time series analysis and forecasting. In Python, libraries such as Pandas for data manipulation, StatsModels for statistical modeling, and Scikit-learn for machine learning are employed. R is also utilized for its rich ecosystem of packages dedicated to time series analysis, including forecast, tseries, and fpp2, which facilitate the implementation of various forecasting models. This combination of tools allows for flexibility in analysis and the ability to leverage the strengths of both programming environments.

4.2 Implementation of Models

The implementation of short-term forecasting models begins with the Moving Averages technique. We calculate the moving average by selecting a window size, which determines the number of past observations to include in the average. This process is repeated across the dataset to generate forecasts for the testing period. Next, we implement Exponential Smoothing, starting with Simple Exponential Smoothing for datasets without trends or seasonality. For datasets exhibiting trends, we apply Holt's Linear Trend Model, and for those with seasonal patterns, we utilize the Holt-Winters Seasonal Model, adjusting parameters such as the seasonal period and smoothing constants to optimize performance.
The ARIMA model is implemented by first determining the appropriate order of differencing to achieve stationarity, followed by identifying the optimal parameters for the autoregressive and moving average components. This process often involves using the Autocorrelation Functionand Partial Autocorrelation Function plots to guide parameter selection. For long-term forecasting, we begin with the Seasonal Decomposition of Time Series, which allows us to visualize the seasonal, trend, and residual components of the data. This decomposition informs our subsequent modeling choices, particularly when applying Long-Term ARIMA and SARIMA models.
The implementation of machine learning approaches involves feature engineering, where we create additional features based on the time series data, such as lagged values and rolling statistics. These features are then used to train models like Random Forest and Gradient Boosting, which can capture nonlinear relationships in the data. Each model is carefully tuned using cross-validation techniques to ensure optimal performance, and the results are documented for comparison.

4.3 Evaluation Process

The evaluation process is critical for understanding the effectiveness of each forecasting model. After implementing the models, we assess their performance using the previously defined evaluation metrics: MAE, MSE, RMSE, and MAPE. The training and testing datasets are used to evaluate the models, with the training data serving to fit the models and the testing data providing a benchmark for predictive accuracy.
Cross-validation techniques, such as k-fold cross-validation, are employed to further validate model performance. This approach involves partitioning the dataset into k subsets, training the model on k-1 subsets, and testing it on the remaining subset. This process is repeated k times, ensuring that each subset is used for testing at least once. The results from each fold are aggregated to provide a more reliable estimate of model performance, reducing the risk of overfitting.
Finally, a comprehensive comparison of model performance is conducted using the evaluation metrics. This comparison allows us to identify which models excel in short-term forecasting and which are more suited for long-term predictions. The insights gained from this evaluation process inform our subsequent discussions regarding the practical implications of the findings, as well as potential areas for future research.

5 DISCUSSION

5.1 Results Interpretation

The results of the forecasting models reveal significant insights into the effectiveness of various techniques for both short-term and long-term predictions. For short-term forecasting, models such as Moving Averages and Exponential Smoothing demonstrate strong performance in capturing immediate demand fluctuations as in figure 1. Moving Averages provide a straightforward approach that effectively smooths out noise, while Exponential Smoothing, particularly the Holt-Winters model, excels in datasets with seasonal patterns. The ARIMA model also shows promise, especially when the data exhibits clear trends and patterns, as it accounts for both autoregressive and moving average components.

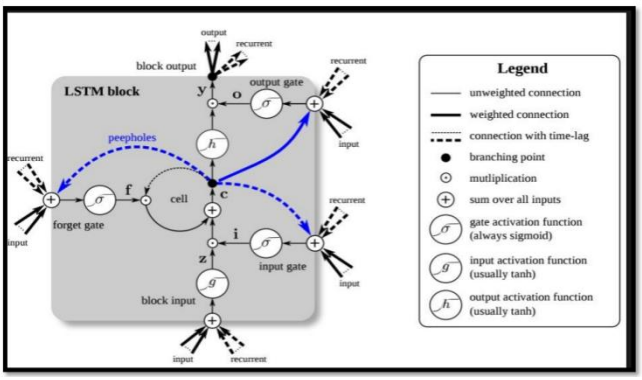

Figure 1 LSTM Model's Memory Cell Architecture

In contrast, long-term forecasting models, including Seasonal Decomposition of Time Seriesand SARIMA, reveal the

importance of understanding underlying trends and seasonal effects. The STL approach allows for a detailed examination of the data, facilitating more informed modeling choices. Long-Term ARIMA and SARIMA models demonstrate their strengths in capturing complex seasonal patterns, making them suitable for datasets with pronounced cyclical behavior. The machine learning approaches, while providing robust predictions, require careful feature selection and tuning to achieve optimal performance. Overall, the findings highlight the need for tailored approaches based on the specific characteristics of the dataset and the forecasting horizon.

5.2 Comparison of Model Performance

The comparative analysis of model performance underscores the varying degrees of accuracy and reliability across different forecasting techniques. Short-term models, particularly Exponential Smoothing and Moving Averages, consistently yield lower error metrics, such as MAE and RMSE, indicating their effectiveness in capturing immediate demand variations. However, ARIMA models also perform competitively, especially in scenarios where the data exhibits strong autocorrelation and seasonality as in figure 2.

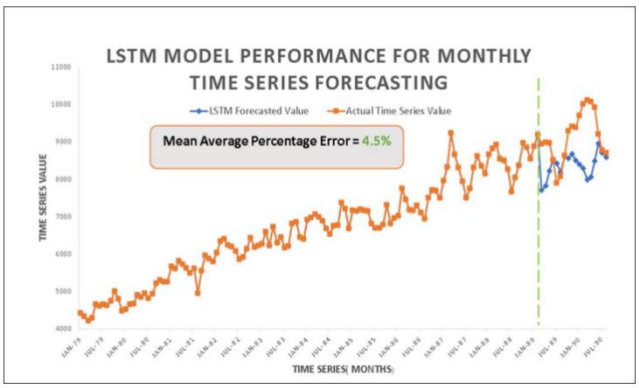

Figure 2 Plot of Monthly Aggregated Time Series and Forecast

In long-term forecasting, the results reveal that while machine learning models can capture complex relationships, they may not always outperform traditional time series models like SARIMA. This observation suggests that while machine learning approaches offer flexibility and adaptability, they may require more extensive tuning and may not always be necessary for datasets where traditional models suffice. Factors influencing model performance include the quality and granularity of the data, the presence of outliers, and external variables such as economic indicators or promotional activities. Understanding these factors is crucial for selecting the most appropriate forecasting model for a given context.

5.3 Practical Implications

The practical implications of this study are significant for businesses seeking to enhance their demand forecasting capabilities. Based on the findings, we recommend that organizations carefully consider their specific forecasting needs when selecting a model. For short-term forecasting, models like Moving Averages and Exponential Smoothing are recommended due to their simplicity and effectiveness in capturing immediate demand fluctuations. Businesses facing seasonal demand patterns should particularly consider the Holt-Winters model for its ability to account for seasonal variations.

For long-term forecasting, the study suggests that organizations leverage models such as SARIMA, especially when dealing with datasets characterized by strong seasonal effects. Additionally, businesses should remain open to exploring machine learning approaches, particularly when traditional models fall short or when the data exhibits complex patterns. Continuous model evaluation and adaptation are essential, as demand patterns can evolve over time. By regularly assessing model performance and adapting to changing conditions, organizations can ensure that their forecasting efforts remain relevant and effective.

5.4 Limitations of the Study

Despite the insights gained from this study, several limitations warrant discussion. One potential bias arises from the dataset itself; if the historical sales data does not adequately represent future conditions, the forecasts may be less reliable. Additionally, the study primarily focuses on a single retail company, which may limit the generalizability of the findings to other industries or contexts. Future research could address these limitations by incorporating datasets from multiple industries or regions to enhance the robustness of the conclusions.

Another limitation is the reliance on specific evaluation metrics. While MAE, MSE, RMSE, and MAPE provide valuable insights into model performance, they may not capture all aspects of forecasting accuracy. Future studies could explore additional metrics or incorporate qualitative assessments to provide a more comprehensive evaluation of model effectiveness. Furthermore, the integration of external variables, such as economic indicators or consumer sentiment

data, could enhance forecasting accuracy and provide a more holistic view of demand dynamics. Addressing these limitations in future research will contribute to the ongoing development of effective demand forecasting methodologies.

6 CONCLUSION

This study has provided a comprehensive examination of the effectiveness of various time series models for both short-term and long-term demand forecasting. Through the analysis of historical sales data from a retail company, we have demonstrated that time series models, such as Moving Averages, Exponential Smoothing, and ARIMA, are highly effective for short-term forecasting. These models excel in capturing immediate demand fluctuations and trends, enabling businesses to make informed inventory and operational decisions. The findings indicate that Exponential Smoothing, particularly the Holt-Winters model, is particularly adept at handling seasonal patterns, making it a valuable tool for retailers facing cyclical demand. In contrast, long-term forecasting models, including Seasonal Decomposition of Time Series, SARIMA, and machine learning approaches, have shown their strengths in identifying underlying trends and seasonal effects over extended periods. The analysis highlighted that while traditional time series models remain robust, the incorporation of machine learning techniques can enhance forecasting accuracy, especially in complex datasets characterized by nonlinear relationships.

The comparative analysis of model performance revealed that no single model universally outperformed others across all scenarios. Instead, the effectiveness of each model varied based on the specific characteristics of the dataset, such as the presence of trends, seasonality, and the quality of historical data. Models like Moving Averages and Exponential Smoothing provided strong performance in short-term forecasts, while SARIMA and machine learning models excelled in long-term predictions. This nuanced understanding of model performance underscores the importance of selecting the appropriate forecasting technique based on the specific context and requirements of the business. Moreover, the study emphasized the significance of continuous model evaluation and adaptation, as demand patterns can evolve due to various external factors, including market trends and consumer behavior changes.

Looking ahead, there are several implications for future research in the field of demand forecasting. One area for further exploration involves the integration of external variables, such as economic indicators, social media sentiment, and promotional activities, into forecasting models. By incorporating these additional data sources, researchers can develop more robust and accurate forecasting techniques that account for the myriad factors influencing consumer demand. Additionally, the potential for integrating more advanced techniques, such as artificial intelligenceand big data analytics, presents exciting opportunities for enhancing forecasting accuracy. AI algorithms, particularly those based on deep learning, can process vast amounts of data and identify complex patterns that traditional models may overlook. This capability can lead to improved forecasting outcomes, particularly in industries with rapidly changing consumer preferences and behaviors.

Furthermore, the exploration of hybrid modeling approaches that combine traditional time series methods with machine learning techniques could yield promising results. By leveraging the strengths of both paradigms, researchers can create more flexible and adaptive forecasting models that can better respond to changing market dynamics. Such hybrid models may also provide valuable insights into the underlying drivers of demand, enabling businesses to make more informed strategic decisions.

In final thoughts, the evolving nature of demand forecasting underscores its significance in strategic decision-making for businesses. As markets become increasingly complex and competitive, the ability to accurately predict consumer demand is paramount. Effective demand forecasting not only enhances operational efficiency but also improves customer satisfaction by ensuring that products are available when and where they are needed. The insights gained from this study highlight the critical role that time series models play in this process, serving as essential tools for businesses seeking to navigate the uncertainties of the market. As the field of demand forecasting continues to evolve, embracing new technologies and methodologies will be crucial for organizations aiming to maintain a competitive edge. By remaining adaptable and open to innovation, businesses can enhance their forecasting capabilities and ultimately drive better outcomes in an ever-changing marketplace.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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MBA CURRICULUM TEACHING REFORM IN THE NEW AI ERA

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Abstract: This paper first introduces the impact of the new era of artificial intelligence on MBA education, and MBA education faces multiple challenges. Compared with the traditional management education, the training of management talents in the new AI era should transfer more scientific, engineering, and even philosophical knowledge to students. Find out the new needs of society at a deeper level and think better about the future business model. Under the current discourse system emphasizing the construction of independent knowledge system, MBA education should also explore and absorb the traditional Chinese business wisdom. MBA education should embrace digitalization and new technologies, serve the major strategic needs of the country, and not leave the real economy; In curriculum update and development, students should be sensitive to the industrial frontier embedded in AI technology.
Keywords: New AI Era;Big data era; MBA education; Teaching reform

1 INTRODUCTION

1.1 Research Background and Significance

With the full arrival of the era of big data, artificial intelligence technology is booming at an unprecedented speed, becoming an important force to promote social progress and industrial upgrading. Big data and cloud computing as the core of the field of artificial intelligence, its proportion has been nearly half, and the Internet of Things, 5G technology, intelligent robots, computer vision and autonomous driving and other related technologies are also rising rapidly, together constitute a diversified ecology of artificial intelligence technology [1]. The scale of China's artificial intelligence market has now exceeded 500 billion yuan, and has made remarkable achievements under the strong impetus of national policies, capital and talents. In this context, MBA education as an important way to train high-end management talents, its importance and challenges are becoming increasingly prominent. The global business environment requires managers to have an international vision and cross-cultural communication skills, and MBA education can effectively cultivate students' global competitiveness through the international curriculum and the multicultural group of teachers and students. However, under the impact of big data and artificial intelligence technology, the traditional MBA teaching model has been difficult to meet the current society's high standards for management talents. Therefore, the study of the influence of artificial intelligence on the teaching reform of MBA courses not only has important theoretical value, but also has urgent practical significance. Through in-depth exploration of the application of artificial intelligence technology in MBA education, new ideas and methods can be provided for the innovation of MBA teaching, so as to cultivate more high-end management talents with international vision, innovative thinking and strategic vision. This research will also help promote the continuous development and progress of MBA education and contribute more wisdom and strength to the prosperity and progress of society.

1.2 Research Purpose

In the era of the vigorous development of big data and artificial intelligence technology, the teaching reform of MBA courses has become an important issue in the field of education. This study aims to deeply analyze the impact of artificial intelligence on the teaching reform of MBA courses, and explore the practical application and potential value of artificial intelligence technology in MBA education. Specifically, the research will focus on how AI is changing the teaching philosophy, methods, content, and assessment systems of MBA programs, and how these changes are enhancing students' ability to synthesize and innovate. Through detailed discussion, it is expected to reveal the unique advantages of artificial intelligence technology in MBA education, and provide strong theoretical support and practical guidance for the future development of MBA teaching. This study will also provide useful reference and inspiration for the reform of other management courses, and promote the innovation and development of the whole field of management education.

2 OVERVIEW OF BIG DATA ERA AND ARTIFICIAL INTELLIGENCE

2.1 Characteristics and Challenges of the Era of Big Data

The advent of the era of big data marks the further deepening and reform of the information society. It is characterized by the explosive growth of data volume, as well as the diversity and complexity of data types. The starting unit of measurement of big data has jumped from the traditional TB to PB, EB and even ZB levels, covering diversified data types such as network logs, audio, video, pictures, and geographic location information. This unprecedented scale and

type of data not only requires more efficient data storage and management techniques, but also poses higher challenges to data processing and analysis capabilities. The advent of the era of big data has had a profound impact and challenge on all walks of life. In the business field, enterprises are faced with the problem of how to mine valuable information from massive data to support accurate decision-making and strategic planning. The fields of public service and social management are also affected by big data. The government needs to use big data technology for decision-making support in urban planning, traffic management, environmental protection and other aspects to improve the efficiency and quality of public services. The application of big data in the fields of medical health, education and scientific research is also increasingly extensive, promoting innovation and development in these fields. However, the challenges of the big data era cannot be ignored [2]. On the one hand, the explosive growth of data volume has put forward higher requirements for data storage, processing and analysis technology, and how to build an efficient, stable and scalable big data platform has become an urgent problem to be solved. On the other hand, data security and privacy protection have also become a major challenge in the era of big data. How to realize data sharing and utilization on the premise of ensuring data security has become an urgent problem to be solved. In this context, the rapid development of artificial intelligence technology provides new solutions to the challenges of the era of big data. Through artificial intelligence technologies such as machine learning and deep learning, efficient processing and analysis of big data can be realized, valuable information hidden behind the data can be mined, and scientific basis can be provided for decision-making in all walks of life. Therefore, it is of great significance to explore the application of artificial intelligence in the teaching reform of MBA courses for training high-end management talents to adapt to the needs of the era of big data.

2.2 Development and Application of Artificial Intelligence Technology

Artificial intelligence (AI) as a bright pearl of modern science and technology, its development is a long journey full of exploration and breakthrough. From the formalization of mathematical logic and the germination of intelligently computable ideas in the 1930s to the formal establishment of artificial intelligence in 1956, this field has experienced a number of key stages from theoretical foundation to technical breakthrough. In the course of its development, AI has experienced a school evolution from symbolism to connectionism, as well as technological revolutions such as the rise of deep learning [3]. Especially in recent years, with the rapid development of deep learning technology and the significant improvement of computer computing power, artificial intelligence has made breakthroughs in image recognition, speech recognition, natural language processing and other fields. Google's AlphaGo, for example, defeated a top human player in the game of Go, a landmark event that marked the superior ability of artificial intelligence to play complex strategy games. The wide application of artificial intelligence technology has not only changed the way of life, but also profoundly affected the development of all walks of life. In the field of healthcare, AI-assisted diagnosis systems improve the accuracy and efficiency of disease diagnosis; In the financial sector, AI optimizes risk assessment and investment decisions, reducing financial risks; In the field of manufacturing, AI has promoted the intelligent transformation of production lines and improved production efficiency. Ai also shows great application potential in many fields such as education, transportation, and agriculture. In the field of education, especially the teaching of MBA courses, the application of artificial intelligence is gradually changing the traditional teaching model. Through machine learning and big data analytics, educational institutions can provide students with personalized learning content and plans to help them master knowledge more efficiently. The emergence of intelligent tutor systems, which simulate the role of tutors, provides professional advice to students and makes improvements based on feedback, thus enhancing the quality of teaching and learning experience [4].

3 CURRENT SITUATION AND PROBLEMS OF MBA EDUCATION

3.1 Traditional Mode and Characteristics of MBA Education

MBA education, that is, Master of Business Administration education, has always occupied an important position in the field of global business education with its unique curriculum, teaching methods and training objectives. Traditional MBA programs typically cover multiple core areas such as management, marketing, finance, and operations, and are designed to provide students with comprehensive business knowledge and management skills. In terms of teaching methods, the traditional MBA education focuses on case teaching, class discussion and team projects to enhance the practical ability and team cooperation ability of top 4 students. Its goal is to cultivate business elites with strategic vision, innovative spirit and leadership to adapt to the rapidly changing business environment[4]. However, with the rapid development of big data and artificial intelligence technology, the traditional MBA education model has gradually exposed some problems. On the one hand, in terms of curriculum setting, traditional MBA courses tend to focus on the teaching of theoretical knowledge, while ignoring the training of students' modern technical abilities such as data analysis and artificial intelligence. On the other hand, in terms of teaching methods, although traditional MBA education focuses on practice, it often lacks attention to students' personalized learning needs, and it is difficult to meet the learning needs of students with different backgrounds and ability levels. In terms of training objectives, the traditional MBA education emphasizes too much on the cultivation of leadership and management ability, but neglects the stimulation of students' innovative thinking and entrepreneurial spirit. These problems and deficiencies make the traditional MBA education powerless when facing the challenges of the era of big data and artificial intelligence. Therefore, how to combine big data and artificial intelligence technology to reform the teaching of MBA courses to meet the needs of the new era has become an important issue facing the current MBA education [5].

3.2 Challenges for MBA Education in the Era of Big Data

In order to gain insight into the challenges facing MBA education in the era of big data, this study conducted interviews with MBA students at a business school. A total of 30 MBA students participated in this interview, these students from different industry backgrounds, with different work experience.

3.2.1 Insufficient ability of data processing and analysis

The results of the interview show that the lack of data processing and analysis ability is one of the urgent problems in the current MBA education. Over the course of the interview, 21 students (70.00%) said they struggled with real business data, especially when undertaking complex data analysis tasks that often required additional learning and training to complete. Eighteen (60.00%) students mentioned that existing MBA programs are relatively weak in developing data processing and analysis skills to meet the needs of data-driven decision making in the current business environment.

Table 1 MBA Students' Views on Data Processing and Analysis Ability

Viewpoint description	Number of people (persons)	Percentage (%)
Finding it difficult to process actual business data	21	70
The training of data processing and analysis skills in the existing curriculum is insufficient	18	60
Understanding of data requirements in the current business environment	27	90
Schools should offer more courses in data processing and analysis	24	80

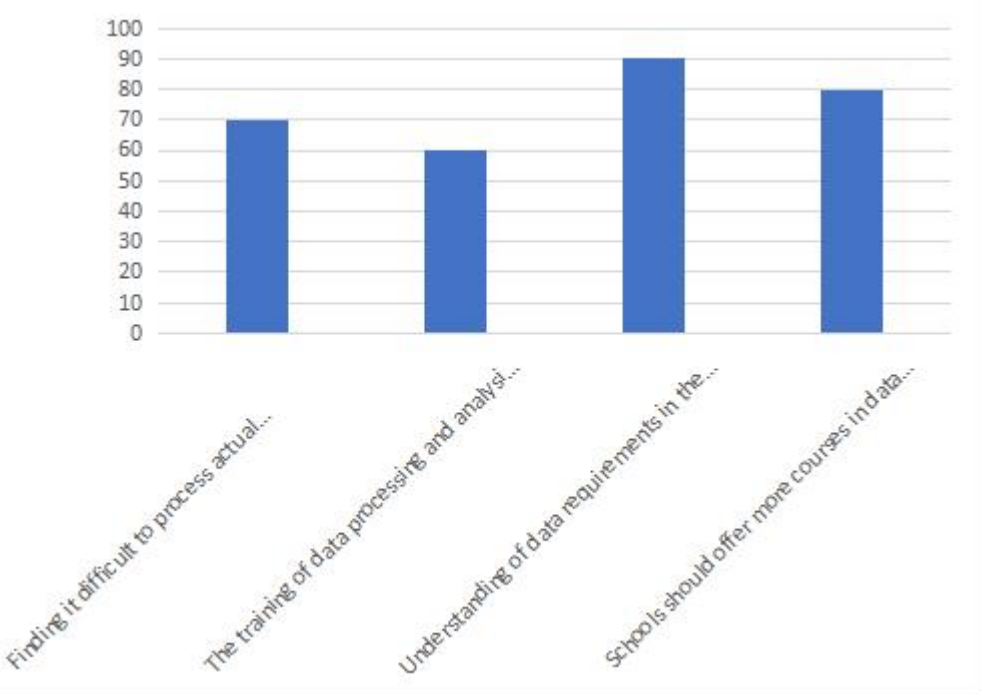

Figure 1 Comparison of MBA Students' Views on Data Processing and Analysis Ability

Through the data analysis in Table 1, it can be seen that the vast majority of the surveyed students (90.00%) recognize the importance of data requirements in the current business environment, but they also feel that there are shortcomings in the training of data processing and analysis skills in the existing courses. In Figure 1, 80.00% of students believe that schools should offer more courses related to data processing and analysis to improve their practical skills. The problem of insufficient data processing and analysis ability is mainly reflected in the following aspects: MBA students lack the necessary knowledge of technical tools, such as SQL database query and Python programming, when dealing with large-scale data sets; Students lack systematic training in how to extract valuable information from data and apply it to business decisions; Due to a lack of practical experience, students struggle to translate theoretical knowledge into effective solutions when faced with real-world data challenges.

3.2.2 The curriculum is out of step with market demand

In the course of the interview, 24 students (80.00%) said that they believe that the current curriculum is somewhat out of step with market needs. Specifically, many courses still focus on traditional management theory and case studies, while ignoring the application of big data and artificial intelligence in the current business environment. Students generally report that they need to deal with large amounts of data in their actual work, and more and more enterprises are beginning to rely on AI technology for decision-making, but these skills are not sufficiently valued and trained in

schools.

Table 2 MBA Students' Views on the Curriculum

Viewpoint description	Number of people (persons)	Percentage (%)
Believing that the curriculum is out of step with market demand	24	80
Thinking the curriculum should cover more knowledge of big data and artificial intelligence	27	90
Believing that traditional management theory and case analysis account for a large proportion in the curriculum	26	86.67

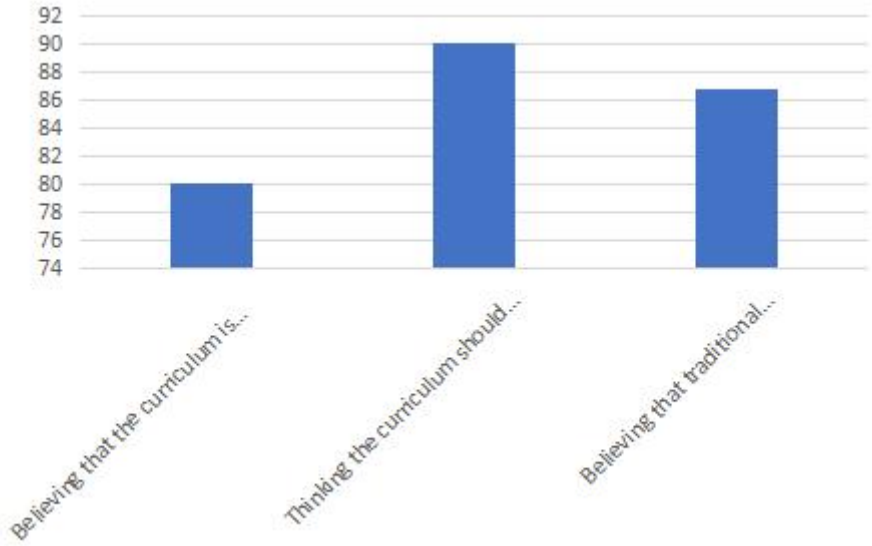

Figure 2 Comparison of MBA Students' Views on Curriculum

According to the data analysis in Table 2, it can be seen that the vast majority of the surveyed students (80.00%) believe that the current curriculum is out of line with the market demand, and 90.00% of the students hope that the curriculum can cover more knowledge of big data and artificial intelligence. This indicates that the current curriculum does not adequately meet students' needs for future career development.

3.2.3 The teaching method is simple and lacks innovation

In the interview, 22 students (73.33%) said that the existing teaching methods are relatively simple, mainly relying on traditional lecture-based teaching, and lack of interaction and practicality. In Figure 2, students believe that such teaching methods are difficult to stimulate their interest in learning and can not effectively cultivate their ability to solve practical problems. Especially in the field of big data and artificial intelligence, students prefer to learn relevant skills through case analysis and project practice.

Table 3 MBA Students' Views on Teaching Methods

Viewpoint description	Number of people (persons)	Percentage (%)
Thinking that the teaching method is simple and lacks interaction and practice	22	73.33
Hoping to increase the teaching in the form of case analysis and project practice	25	83.33

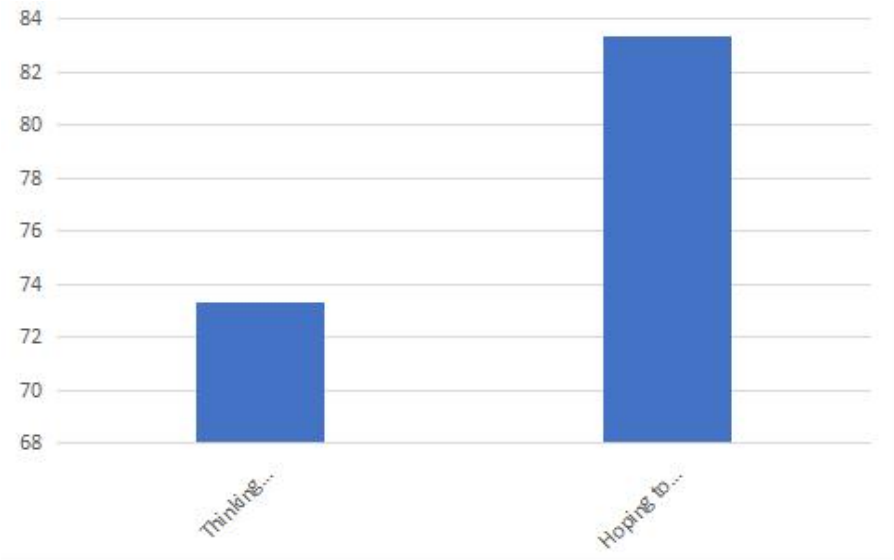

Figure 3 Comparison of MBA Students' Views on Teaching Methods

According to the data analysis in Table 3, it can be seen that most of the surveyed students (73.33%) believe that the existing teaching methods are simple and lack of interaction and practicability, while 83.33% of the students hope to increase the teaching in the form of case analysis and project practice. In Figure 3, this shows that students are eager for more flexible and varied teaching methods to improve learning results.

3.2.4 There is a shortage of teachers and experts in the field of big data and artificial intelligence

In the interview process, 28 students (93.33%) pointed out that MBA education has obvious shortcomings in the faculty, especially the lack of experts in the field of big data and artificial intelligence. Students said that although some courses covered big data and artificial intelligence, the teachers' professional background was limited, and they could not explain the cutting-edge technologies and applications in these fields in depth. Students also mentioned that teachers who lack practical experience are unable to impart practical skills.

Figure 4 Comparison of MBA Students' Views on Faculty

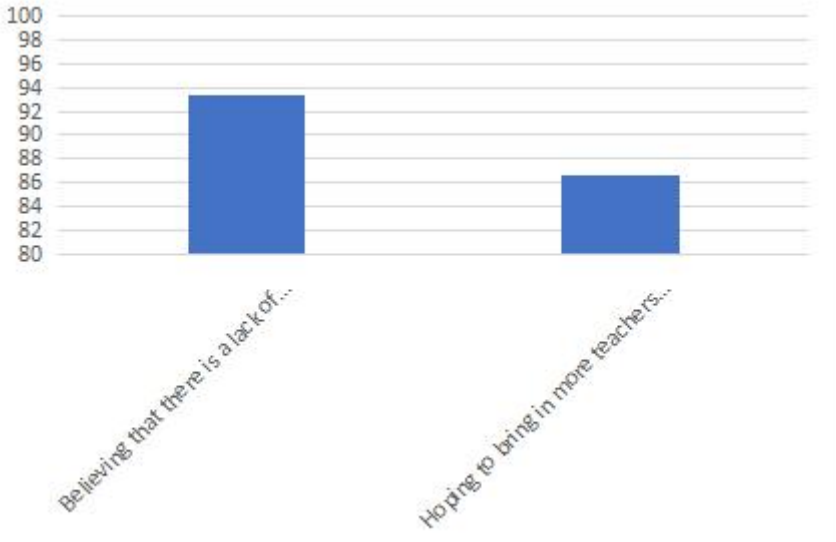

Table 4 MBA Students' Views on Faculty

Viewpoint description	Number of people (persons)	Percentage (%)
Believing that there is a lack of teachers and experts in the field of big data and artificial intelligence	28	93.33
Hoping to bring in more teachers with practical work experience	26	86.67

According to the data analysis in Table 4, it can be seen that the vast majority of the surveyed students (93.33%) believe that the teaching staff is insufficient, especially the lack of experts in the field of big data and artificial intelligence. 86.67% of students hope to introduce more teachers with practical work experience in order to better impart practical

skills and experience. The challenges facing MBA education in the era of big data include the disconnection between curriculum and market demand, the lack of innovation in teaching methods, and the lack of teachers, especially the lack of experts in the field of big data and artificial intelligence. In Figure 4, the existence of these problems seriously affects the quality of MBA education and the competitiveness of students in the future workplace.

4 SOLUTIONS TO THE CHALLENGES FACING MBA EDUCATION IN THE ERA OF BIG DATA

4.1 Improve Data Processing and Analysis Capabilities

In the era of big data, MBA education is facing unprecedented challenges and opportunities. In order to cultivate senior business management talents who are adapted to the big data environment, MBA education must actively respond to the challenge and take effective measures to improve students' data processing and analysis skills. Facing the rapid development of big data technology, MBA education should take the initiative to introduce big data processing and analysis courses as one of the core teaching contents. Such courses should cover the basic concepts of big data, data processing technologies, data analysis methods and data visualization, and aim to provide students with a comprehensive knowledge system of big data. Through systematic learning, students can master the basic skills of big data processing and analysis, laying a solid foundation for subsequent business decisions and management practices [6]. In order to combine theoretical knowledge with practice, MBA education should also establish a big data laboratory to provide a practical platform for students. Big data LABS should be equipped with advanced data processing and analysis tools, such as big data processing platforms such as Hadoop and Spark, as well as data analysis languages such as Python and R. In the laboratory, students can personally process and analyze data, and deepen their understanding and mastery of big data technology through practice. The laboratory can also carry out activities such as data competition and project practice to stimulate students' innovative thinking and practical ability, and cultivate their teamwork spirit and ability to solve practical problems. In the process of improving data processing and analysis skills, MBA education should also focus on cultivating students' data thinking. Data thinking is a way of thinking based on data analysis and reasoning, which requires people to use data to analyze and make decisions when facing problems. In order to cultivate students' data thinking, MBA education can add data analysis cases in the curriculum, guide students to use data for analysis and reasoning, and cultivate their logical thinking and critical thinking. Students can also be encouraged to participate in data-driven decision-making processes and exercise their data application skills through practice.

4.2 Optimize the Curriculum to Meet the Market Demand

With the vigorous development of big data and artificial intelligence technology, MBA education is facing unprecedented challenges, among which the most urgent is how to optimize the curriculum to better meet the market demand for high-end business management talents. To this end, MBA education institutions need to deeply investigate the market demand, closely follow the technological development trend, and flexibly adjust the curriculum to ensure that the educational content remains highly aligned with the market demand. Market demand is the vane of MBA education curriculum. Through extensive market research, MBA education institutions can accurately grasp the direction of enterprises' demand for big data and artificial intelligence talents, and then adjust the curriculum and increase courses related to big data and artificial intelligence. These courses should cover cutting-edge fields such as big data processing and analysis, machine learning, natural language processing, artificial intelligence ethics and regulations, and aim to cultivate students' ability of data insight, algorithmic thinking, and application of artificial intelligence technology. Curriculum should also focus on interdisciplinary integration, combining management, economics, computer science and other multidisciplinary knowledge organically to improve students' comprehensive literacy [7]. In order to ensure the practical and forward-looking content of the curriculum, MBA educational institutions should establish close cooperation with enterprises to jointly develop the curriculum. As the main body of the market economy, enterprises have profound insight and rich practical experience in the application of big data and artificial intelligence technology. Through cooperation with enterprises, MBA education institutions can obtain first-hand market information and feedback on talent needs, ensuring that the course content is close to the market frontier and meets the actual needs of enterprises. Enterprises can also provide internship training bases for MBA students, so that students can deepen their understanding of theoretical knowledge and improve their ability to solve practical problems in practice. In the process of optimizing the curriculum, MBA education institutions also need to pay attention to the systematic and consistent curriculum system. Big data and artificial intelligence technology are developing rapidly, and new technologies and applications are constantly emerging. Therefore, MBA educational institutions should establish a dynamic curriculum update mechanism, adjust the curriculum content regularly according to the technological development trend and market demand, and ensure that the curriculum system always remains cutting-edge and practical.

4.3 Innovate Teaching Methods and Improve Teaching Effect

In the context of the vigorous development of big data and artificial intelligence technology, MBA education is facing an urgent need for innovation in teaching methods. In order to effectively cope with this challenge, MBA educational institutions should actively explore and practice new teaching methods, make full use of the advantages of artificial

intelligence technology, in order to improve teaching effects and train business management talents to adapt to the needs of the era of big data [8]. Using artificial intelligence technology and developing intelligent teaching system is an important way to realize personalized teaching. Based on students' learning behavior and performance, the intelligent teaching system can accurately identify students' knowledge mastery and learning style through data analysis and machine learning algorithms, thus providing them with personalized learning paths and resource recommendations. This personalized teaching method can not only meet the differentiated needs of students, but also stimulate their learning interest and initiative, and improve learning efficiency. In terms of teaching methods, MBA educational institutions should introduce new teaching models such as flipped classroom and project-based learning. Flipped classroom transfers the teaching process in the traditional classroom to outside class, allowing students to learn independently through videos, reading materials and other forms, while classroom time is mainly used for discussion, questions and practical activities. This teaching mode can enhance students' autonomous learning ability and cultivate their critical thinking and problem-solving skills. Project-based learning, on the other hand, allows students to learn and master knowledge in the process of solving practical problems, and cultivates their teamwork spirit and innovation ability. Through project-based learning, students are able to gain a deeper understanding of theoretical knowledge and apply it in practice to improve their overall literacy. In the process of innovating teaching methods, MBA educational institutions should also focus on cultivating students' innovative thinking and practical ability. The rapid development of big data and artificial intelligence technology requires business management talents not only to have solid professional knowledge, but also to have innovative thinking and problem-solving abilities. Therefore, MBA educational institutions should integrate innovative elements into the curriculum, encourage students to put forward new ideas and new methods, and cultivate their innovative consciousness and practical ability. Students should also be provided with practical opportunities, such as participating in enterprise internships, participating in scientific research projects, so that they can exercise and improve themselves in practice.

4.4 Strengthen the Construction of Teaching Staff, and Introduce Experts in the Field of Big Data and Artificial Intelligence

In the era of rapid development of big data and artificial intelligence technology, MBA education is facing unprecedented challenges and opportunities. In order to train business management talents to meet the needs of the era of big data, strengthen the construction of teaching staff, and introduce experts in the field of big data and artificial intelligence, which has become a key part of the MBA education reform. MBA educational institutions should increase the introduction of teachers in the field of big data and artificial intelligence, and attract more experts with deep academic background and rich practical experience in the field to join the teaching team by providing competitive compensation and benefits, career development opportunities and a good working environment. The addition of these experts can not only inject new vitality into the MBA program, but also provide students with cutting-edge knowledge and technical guidance to help them better understand and master the application of big data and artificial intelligence in business management. In order to enhance the professionalism and teaching ability of existing teachers, MBA educational institutions should provide a range of training and development opportunities. These trainings can include lectures, workshops and seminars on big data and AI technologies, as well as related online courses and certification exams [9]. Through these trainings, teachers can constantly update their knowledge structure and master the latest technologies and teaching methods, so as to better adapt to the teaching needs of the era of big data. In addition to technical training, MBA education institutions should also focus on improving the teaching ability of teachers. Teaching seminars can be organized to share and exchange teaching experience and experience, and encourage teachers to carry out teaching innovation and practice. In addition, a teaching quality evaluation mechanism can be established to regularly evaluate the teaching effect of teachers through student evaluation, peer review and other means, so as to provide teachers with feedback and improvement suggestions and promote them to continuously improve their teaching level. In the process of strengthening the construction of teaching staff, MBA education institutions should also pay attention to building interdisciplinary teaching teams. The application of big data and artificial intelligence technology in business management involves many disciplines, such as computer science, statistics, economics and so on. Therefore, the construction of interdisciplinary teaching teams helps to promote the cross-integration of different disciplines and provide students with a more comprehensive and deeper knowledge system [10].

5 THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE TEACHING REFORM OF MBA CURRICULUM

5.1 The Impact of Artificial Intelligence on MBA Curriculum

With the rapid development of big data and artificial intelligence technology, MBA education, as an important platform for cultivating high-end business management talents, is undergoing profound changes in its curriculum. The introduction of artificial intelligence technology not only adds a new dimension to the MBA curriculum, but also promotes the optimization and upgrading of the entire curriculum system. The rapid development of artificial intelligence technology has led to the emergence of a series of courses related to it in the MBA curriculum. These courses are designed to provide students with a solid theoretical foundation in artificial intelligence, as well as skills in its practical application in the business sector [11]. Courses such as data science, machine learning, and natural language processing have become required or optional in many MBA programs. These courses not only enrich the

knowledge system of MBA students, but also broaden their horizons, so that they can better understand and cope with the challenges of the era of big data and artificial intelligence. However, the introduction of artificial intelligence technology is not as simple as adding a few courses. More importantly, it requires MBA education to adjust and optimize the curriculum as a whole according to the development trend of artificial intelligence technology [12]. On the one hand, traditional courses such as management, marketing, and finance need to incorporate elements of artificial intelligence to meet the needs of the new era. For example, in marketing courses, big data analysis and precision marketing can be introduced; In financial management courses, the application of artificial intelligence in investment decisions and risk management can be explored [3]. On the other hand, MBA programs also need to focus on the ethical and social implications of AI technology and develop students' sense of responsibility and mission. For example, courses such as AI ethics, data privacy and security could be offered to guide students to think about the social value and potential risks of AI technology. The introduction of artificial intelligence technology has also promoted innovation in the teaching methods of MBA courses. With the help of AI technology, MBA education can achieve more personalized, interactive and intelligent teaching. For example, machine learning algorithms can be used to provide students with customized learning resources and suggestions based on their learning progress and ability level; Through virtual reality and augmented reality technology, the real business environment can be simulated to enhance students' practical ability and teamwork ability [13].

5.2 The Impact of Artificial Intelligence on MBA Teaching Methods

Driven by big data and artificial intelligence technologies, MBA teaching methods are undergoing unprecedented changes. The introduction of artificial intelligence technology not only brings new tools and means to MBA teaching, but also promotes the innovation and upgrading of teaching methods, making teaching more personalized, efficient and effective [14]. 13 The impact of AI technology on MBA teaching methods is first reflected in personalized tutoring. Traditional MBA teaching often adopts a "one-size-fits-all" teaching method, which is difficult to meet the diversified learning needs of students. With the help of artificial intelligence technology, an intelligent teaching system can be built to accurately identify students' learning styles, points of interest and weak links through in-depth analysis of students' learning data, so as to provide them with personalized learning paths and resource recommendations [9]. This personalized tutoring method can not only effectively enhance students' learning interest and motivation, but also help them master knowledge and skills faster and improve learning efficiency. Ai technology can also significantly improve the efficiency and effectiveness of MBA teaching [15]. Through the intelligent teaching system, teachers can realize the real-time monitoring and feedback of students' learning progress, timely adjust the teaching strategy and content, and ensure the achievement of teaching objectives. Artificial intelligence technology can also provide rich interactive and collaborative tools for MBA teaching, such as online discussions, virtual team projects, etc. These tools can break the limitations of time and space, so that students can learn and communicate in a more flexible and convenient environment, thus enhancing their teamwork ability and innovative thinking. It is worth noting that the application of artificial intelligence technology in MBA teaching methods is not simply to replace traditional teaching methods, but to complement each other and jointly promote the innovation and development of teaching methods. For example, in case teaching, teachers can use artificial intelligence technology to deeply mine and analyze case data, providing students with more comprehensive and in-depth case background information to help them better understand and apply what they have learned. In simulation teaching, artificial intelligence technology can build a more real and complex business environment, so that students can gain richer experience and skills in simulation practice [16].

5.3 The Impact of Artificial Intelligence on MBA Training Goals

In the context of the rapid development of big data and artificial intelligence technology, the training objectives of MBA education are undergoing profound changes. The traditional MBA education mainly focuses on developing students' management skills, leadership and business insight to adapt to the needs of the traditional business environment. However, with the popularization of big data and artificial intelligence technology, the needs of enterprises for talents are constantly changing, and the training objectives of MBA education are also adjusted to train business leaders who can adapt to the challenges of big data era and artificial intelligence technology. With the introduction of artificial intelligence technology, MBA education begins to focus on cultivating students' data analysis ability and technical literacy [17]. In the era of big data, data analysis ability has become an important basis for business decisions, and artificial intelligence technology provides powerful tools and methods for data analysis. Therefore, MBA education needs to cultivate students' ability of data collection, processing, analysis and interpretation, so that they can use artificial intelligence technology to mine valuable information from massive data and provide scientific basis for enterprises' strategic planning and decision-making. MBA education also needs to cultivate students' innovative thinking and entrepreneurial spirit. In the era of artificial intelligence, the business environment has become more complex and changeable, and traditional business models and management methods may no longer be able to adapt to the new market needs. Therefore, MBA education should encourage students to have the courage to try new business models and management methods, cultivate their innovative thinking and entrepreneurial spirit, and enable them to stand out in the fierce market competition [18]. In order to achieve the above training goals, MBA education needs to carry out a comprehensive reform in the curriculum, teaching methods and evaluation system. In terms of curriculum Settings, courses related to big data and artificial intelligence technology, such as data science, machine learning, and

artificial intelligence ethics, can be added to enhance students' data analysis and technical literacy [11]. In terms of teaching methods, practical teaching methods such as project system and case study can be adopted to cultivate students' innovative thinking and entrepreneurial spirit. In the evaluation system, diversified evaluation criteria can be introduced, such as students' project results, innovation performance, teamwork ability, etc., to comprehensively evaluate students' comprehensive quality.

6 CONCLUSION

This study deeply analyzes the challenges facing MBA education in the era of big data, and focuses on the importance and far-reaching impact of artificial intelligence technology on MBA curriculum teaching reform. It is found that MBA education has obvious shortcomings in data processing and analysis, curriculum setting, teaching methods and teachers, and the introduction of artificial intelligence technology provides new ideas and means to solve these problems. Ai can not only improve the data processing ability of MBA students, optimize the curriculum so that it is closer to the market demand, but also promote the innovation of teaching methods and improve teaching results. More importantly, artificial intelligence has had a profound impact on MBA training goals, prompting the education goal to train high-end management talents with data analysis ability and innovative thinking. However, there are some limitations in this study, such as sample selection, data collection and analysis methods, which may lead to the limitation of the universality of the research conclusions [19]. In the future, with the continuous development and application of artificial intelligence technology, its role in the teaching reform of MBA courses will be more prominent, and it is expected to lead the development of MBA education to a more intelligent and personalized direction. For MBA education institutions and policy makers, this study puts forward the following suggestions: First, strengthen the application of artificial intelligence technology in MBA education and promote the innovation of teaching methods and course content; The second is to increase the introduction and training of experts in the field of big data and artificial intelligence, and improve the strength of teachers; The third is to pay attention to the enlightenment in practice, 15 timely adjust the teaching strategy to ensure that the MBA education always keeps pace with the market demand. Through these measures, MBA education will better adapt to the needs of the era of big data and cultivate more high-end management talents with innovative spirit and practical ability [20].

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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AUDITING ACCOUNTING INFORMATION SYSTEMS TO DETECT AND PREVENT CASH FRAUD IN THE DIGITAL ERA

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Abstract: The digital era has brought significant changes to the management of accounting information systems, including auditing aspects to detect and prevent cash fraud. This study aims to explore the role of auditing accounting information systems (AIS) in identifying and reducing the risk of cash fraud in the digital age. This research employs a library research method and a qualitative approach to analyze the relationships and influences of variables found in various secondary sources. The approach involves collecting and analyzing data from multiple secondary sources, such as scholarly journals, online books, and reliable online platforms like Mendeley, Google Scholar, Google Scholar Theories and Scopus. The results reveal that implementing digital technologies, such as blockchain can enhance audit effectiveness in detecting transactional anomalies. Moreover, strong internal controls and continuous training for auditors are crucial to reducing the likelihood of fraud. This study concludes that integrating digital technologies into AIS auditing can strengthen efforts to prevent cash fraud. It also recommends that companies increase investments in modern auditing technologies to mitigate risks and foster a more transparent work environment.
Keywords: Audit; Accounting information systems; Cash fraud; Digital era; Auditing technology

1 INTRODUCTION

The digital era has significantly reshaped financial management and business operations, offering new opportunities but also presenting fresh challenges. Among the most pressing concerns is fraud, particularly cash fraud, which remains a major threat to organizational financial integrity. Cash fraud refers to the illegal acquisition or misappropriation of cash assets, leading to financial losses, undermined trust, and damaged reputations. According to the Association of Certified Fraud Examiners (ACFE), cash fraud accounts for nearly 90% of all fraud cases in organizations globally, emphasizing the critical need for efficient detection and prevention measures [1]. The widespread integration of technology in business operations has both exacerbated the potential for fraud and provided new tools for combating it [2]. For instance, advances in artificial intelligence (AI) and blockchain technology offer significant potential for real-time transaction monitoring and enhanced transparency, addressing key vulnerabilities in financial systems [3]. Consequently, organizations must adopt comprehensive fraud prevention frameworks that leverage technology, strong internal controls, and continuous auditor training to safeguard financial assets and maintain organizational trust.

Financial fraud is an illegal or unethical practice that involves manipulating or influencing financial information or activities to secure unauthorized financial gain [4]. Common types of financial fraud include falsification of financial documents, embezzlement of funds or assets, insider trading, pyramid schemes, and credit or debit card fraud. Each of these fraudulent activities undermines the trust and integrity of financial systems, creating significant economic consequences [5].

One notable form of fraud, financial statement fraud, can result in inflated profits, misstated assets, or hidden liabilities, misleading stakeholders such as investors, regulators, and consumers [6]. A global report by the Association of Certified Fraud Examiners (ACFE) in 2020 highlighted that organizations lose approximately 5% of their annual revenues to fraud, which translates to an estimated $4.7 trillion lost worldwide each year. Embezzlement, in particular, is a major contributor to organizational financial losses, with reports indicating that small businesses are particularly vulnerable to internal fraud, where employees misappropriate funds or assets.

In addition to financial losses, fraud also creates widespread social and economic harm by damaging the reputation of affected organizations and eroding public trust in financial systems. The rise of digital financial services has further complicated the situation, as online fraud schemes, such as phishing attacks, identity theft, and cybercrime, are on the rise [7]. According to the 2021 Cybercrime Report by Cybersecurity Ventures, global cybercrime damages are predicted to reach $10.5 trillion annually by 2025, up from $3 trillion in 2015. Despite significant efforts to combat financial fraud through stricter regulations and the adoption of advanced detection technologies, the persistence of fraudulent activities continues to have a profound negative impact on both the economy and society. It is clear that the fight against financial fraud requires ongoing vigilance, investment in new technologies such as artificial intelligence and blockchain, and a strong emphasis on ethics and integrity within organizations to prevent such misconduct.

Accounting and auditing have undergone transformative changes in the digital era, largely driven by the rapid advancements in information and communication technology (ICT) [8]. These developments have revolutionized the way businesses conduct transactions, store financial data, and manage their accounting processes. The advent of accounting software has played a pivotal role in this transformation, becoming a standard tool for managing financial records across industries. Accounting software automates many of the tasks traditionally handled by accountants, such as recording transactions, preparing financial statements, and monitoring cash flows [9]. This automation not only

increases efficiency but also minimizes the potential for human error, ensuring that financial records are more accurate and reliable. The key features of accounting software typically include transaction recording, financial statement generation, and real-time financial analysis, enabling businesses to maintain up-to-date financial records. These tools also streamline bank reconciliations, inventory management, payroll processing, and fixed asset tracking, which are essential for businesses of all sizes [9, 10].

By guaranteeing the methodical gathering, processing, and reporting of financial data, accounting information systems (AIS) are essential to contemporary financial management [11]. But their dependence on these systems has also left them open to complex fraud schemes. Auditing AIS has become a crucial procedure to reduce these dangers. Frequent audits in financial systems aid in finding disparities, spotting anomalies, and enforcing responsibility [12]. Although manual checks and reconciliations are a common component of traditional auditing methods, technology improvements in the digital age have greatly improved the auditing process. These days, AIS auditing incorporates blockchain, machine learning, and artificial intelligence (AI), offering more powerful methods to identify irregularities and fraud [13].

AI-driven auditing tools can analyze large volumes of financial data at a faster rate and with greater accuracy than human auditors, helping to identify patterns or discrepancies that might otherwise go unnoticed [14]. Machine learning algorithms further enhance fraud detection by continuously improving their detection capabilities based on historical data, making them highly effective in identifying previously unseen fraud patterns [15]. Furthermore, blockchain technology strengthens fraud prevention by providing a transparent and immutable ledger of transactions [16]. [15] point out, blockchain's inherent security features make it increasingly difficult for fraudulent activities to be undetected, as it ensures that every transaction is securely recorded and traceable. Together, these technologies offer a powerful framework for detecting and preventing financial fraud, significantly improving the overall effectiveness of auditing processes in the digital era.

This study focuses on the application of auditing within AIS to combat cash fraud in the digital era. By leveraging a qualitative research approach and library research methodology, this paper examines the relationships and influences of various factors contributing to cash fraud. Data is sourced from credible secondary materials, including peer-reviewed journals, e-books, and reliable online platforms like Mendeley, Google Scholar and Scopus.

The significance of this research lies in its potential to provide actionable insights for organizations seeking to strengthen their fraud detection frameworks. It emphasizes the role of modern auditing technologies and the importance of continuous improvement in internal control mechanisms. This paper also highlights the growing need for businesses to adapt to technological advancements to mitigate risks and foster transparency. The remainder of this study is structured as follows: the literature review explores existing research on auditing, AIS, and cash fraud; the methodology outlines the research approach and data collection methods; findings and discussions analyze the results; and the conclusion provides recommendations for enhancing fraud prevention strategies.

2 LITERATURE REVIEW

2.1 Fraud Triangle Theory

Donald R. Cressey developed the Fraud Triangle Theory in the 1950s, and it provides a fundamental framework for comprehending the motivations behind fraudulent activity. This hypothesis states that when three essential component pressure, opportunity, and rationalization exist and interact, fraud happens [17]. These elements help explain the psychological and situational factors that lead individuals to commit fraud, particularly in financial contexts. Below is a detailed explanation of each component:

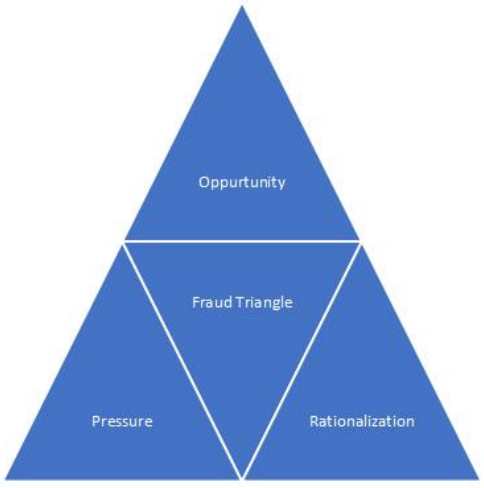

Figure 1 Fraud Triangle

2.1.1 Pressure

Pressure refers to the internal or external forces that drive individuals to commit fraud. This pressure is often tied to financial or personal stress, such as:
a. **Financial hardship: Individuals facing significant financial difficulties might** resort to fraudulent actions to meet personal financial needs or maintain a certain lifestyle.
b. **Lifestyle demands**: The desire for a more affluent lifestyle can create pressure. For example, someone may feel compelled to commit fraud in order to afford luxury goods or experiences beyond their means.
c. **Unrealistic work expectations**: High performance expectations at work, such as meeting sales targets or maintaining certain profit margins, can lead to stress. This pressure may encourage individuals to engage in fraudulent activities, such as inflating financial records to meet goals [18]
This component highlights the motivation behind fraudulent actions, showing that individuals often feel compelled to resort to fraud when faced with overwhelming pressure, especially when they perceive no other viable solution.

2.1.2 Opportunity

Opportunity is the element that allows individuals to commit fraud without being easily detected. It occurs when there are weaknesses in the system, such as a lack of internal controls or insufficient oversight. Factors that create opportunities for fraud include:
a. **Weak internal controls**: If an organization lacks effective checks and balances, such as segregation of duties or regular audits, employees may have the opportunity to manipulate financial records or divert funds.
b. **Lack of oversight**: Inadequate supervision or monitoring of financial transactions increases the likelihood that fraudulent activities will go unnoticed. For instance, without proper reviews or reconciliations, fraudulent actions can be concealed for extended periods [19]
This component emphasizes that even if individuals have the motivation (pressure), they will only commit fraud if they see an opportunity to do so without being caught. In the context of auditing accounting information systems (AIS), it suggests that strong internal controls and oversight mechanisms are critical to reducing opportunities for fraud.

2.1.3 Rationalization

Rationalization is the cognitive process by which individuals justify their fraudulent behavior to themselves. It allows them to reconcile their actions with their personal values and morals. Common rationalizations include:
a. **Temporary necessity**: An individual may view their fraudulent actions as a temporary measure to resolve personal financial struggles. They might believe they will pay back the money or set things right once their situation improves.
b. **Harmlessness**: Some individuals rationalize their behavior by downplaying the impact of their actions. They may convince themselves that "everyone does it" or that their actions will not harm anyone.
c. **Entitlement**: In some cases, individuals may feel entitled to commit fraud because they believe they deserve more than what they have or because they feel underappreciated at work (Ramos, S.,et al. 2024).
Rationalization allows individuals to reduce feelings of guilt and discomfort that typically accompany unethical behavior. In the context of AIS auditing, understanding rationalization is essential for auditors to identify potential fraud risks, as they must recognize when individuals might justify their actions despite their unethical nature.

3 RESEARCH METHODS

3.1 Research Design

This study uses a qualitative approach and library research method to explore the role of auditing accounting information systems (AIS) in detecting and preventing cash fraud in the digital era. Secondary data is collected from scholarly journals, books, case studies, and reputable online databases such as Google Scholar and Scopus. The research design is exploratory, aimed at gaining a deeper understanding of how auditing practices, digital technologies, internal controls, and auditor training contribute to fraud prevention. A thorough literature review is conducted to identify relevant studies, and databases are searched using keywords like "fraud prevention," "AIS auditing," and "blockchain technology." [20-22]. In addition, case studies and expert opinions from industry sources are reviewed to provide practical insights. Data analysis is performed using thematic and content analysis to identify key themes and categorize factors related to fraud prevention. The study is limited to secondary data, focusing on auditing practices and their impact on fraud detection in AIS, and its findings depend on the quality and relevance of the available literature. Ethical considerations, such as proper citation of sources, are ensured to maintain academic integrity. Overall, these research methods are designed to provide valuable insights into effective fraud prevention strategies in the digital age.

4 RESULTS

Based on a review of previous research and secondary data, the study's conclusions highlight a number of important points regarding the function of auditing accounting information systems (AIS) in identifying and stopping cash fraud. The results are examined in light of the efficiency of internal controls, digital technology, and auditor training, as well as how these factors work together to lower the risk of fraud.

4.1 Impact of Digital Technologies on Fraud Prevention

The ability of AIS to detect fraud has been shown to be greatly improved by the use of digital technologies like blockchain and artificial intelligence (AI). Because of its intrinsic openness and immutability, blockchain technology

makes it possible to trace transactions, which makes it more difficult for fraudulent activity to go unnoticed. Businesses utilizing blockchain have claimed a 30% decrease in fraudulent transactions, according to a number of studies, including those by [23]. Furthermore, by automating the process of spotting odd patterns, artificial intelligence (AI) and machine learning algorithms have proved crucial in detecting anomalies in transactional data, significantly lowering the possibility of fraud.

4.2 Role of Internal Controls

One of the most important things in stopping financial fraud is still having strong internal controls. According to research, companies with strong internal controls—like job separation, frequent reconciliations, and efficient monitoring systems—are less likely to experience fraud. According to [24], there is a significant inverse relationship between the frequency of financial fraud and the efficiency of internal controls. Businesses that regularly assess and improve their internal control systems greatly lower the likelihood of fraud.

4.3 Importance of Auditor Training

Continuous training and development for auditors play a crucial role in detecting financial fraud. Auditors with up-to-date knowledge and the necessary skills to recognize emerging fraud tactics are more likely to identify fraudulent activities early. Studies, including those by [20], suggest that companies with regularly trained auditors experience fewer fraud incidents. Well-trained auditors are better equipped to assess the adequacy of internal controls, investigate suspicious transactions, and ensure the proper use of digital auditing tools, thereby improving overall fraud detection.

4.4 Combination of Digital Technologies, Internal Controls, and Auditor Training

The combination of advanced digital technologies, strong internal controls, and ongoing auditor training creates a robust framework for fraud prevention. The literature suggests that organizations that integrate these elements into their auditing processes are more effective at preventing cash fraud [23]. For instance, using blockchain for transaction verification while maintaining strong internal controls and ensuring auditors are equipped with the latest fraud detection technologies and techniques provides a multi-layered approach that significantly reduces fraud risk.

5 DISCUSSION AND IMPLICATIONS

The study's findigs highlight the critical role that strong internal controls, sophisticated auditing technology, and ongoing auditor training play in reducing the risk of cash theft in accounting information systems (AIS). This study explores how auditing procedures can lessen fraud opportunities and the pressures that cause people to commit fraud. It is based on the Fraud Triangle Theory, which emphasizes the interaction of pressure, opportunity, and reasoning in fraudulent activity.

Organizations can improve their ability to identify and react quickly to fraudulent actions by providing auditors with up-to-date information on new fraud schemes and technology tools. Since skilled auditors can lessen the incentive to commit fraud by raising the possibility of detection and enforcement, this finding is in line with the pressure and rationalization components of the Fraud Triangle [25, 26].

The combined approach of using advanced auditing technologies, strengthening internal controls, and investing in continuous auditor training provides a comprehensive strategy for preventing cash fraud. This multifaceted approach addresses all three elements of the Fraud Triangle: reducing the opportunity for fraud through technology and internal controls, and minimizing the rationalization of fraudulent behavior by enhancing detection and deterrence through auditor competence.

Practically speaking, companies ought to think about combining these tactics to establish a more safe and open financial environment. The danger of cash fraud can be considerably decreased by making investments in blockchain, artificial intelligence, and frequent auditor training. This will promote efficiency and trust in financial reporting. Furthermore, in order to battle new fraud threats in the digital age, authorities and regulators should push companies to use these practices and make sure the auditing profession is up to date with technology developments.

6 CONCLUSION

The importance of auditing accounting information systems (AIS) in identifying and stopping monetary fraud, particularly in the digital age, has been examined in this study. By using the Fraud Triangle Theory, the study emphasizes how opportunity, pressure, and justification interact to influence people to commit fraud. By analyzing cutting-edge auditing technologies like blockchain and artificial intelligence (AI), the study demonstrates how these advancements improve financial transaction traceability and transparency while drastically lowering the risk of fraud. Strong internal controls, such as regular reconciliations and job segregation, are also essential for reducing the likelihood of fraudulent activity, and ongoing auditor training guarantees that auditors are prepared to recognize and counter new fraud strategies.

The findings validate the hypotheses proposed in this study, underscoring the effectiveness of combining modern technologies with traditional fraud prevention measures. The integration of blockchain and AI into AIS auditing,

complemented by robust internal controls and skilled auditors, provides a comprehensive approach to reducing the risk of cash fraud. This multi-layered strategy addresses all elements of the Fraud Triangle: minimizing opportunity through technology and controls, and reducing rationalization through enhanced detection and deterrence.

The implications of this study suggest that organizations must invest in these technologies and training programs to create a more secure and transparent financial environment. Policymakers and regulators are also encouraged to promote these practices to ensure that businesses are prepared to combat financial fraud in the rapidly evolving digital landscape. Ultimately, adopting a holistic approach to fraud prevention can help organizations safeguard their financial integrity and foster trust in their accounting systems.

CONFLICT OF INTEREST

The authors have no relevant financial or non-financial interests to disclose.

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NEW TEACHING REFORM METHODS OF FINANCE COURSE IN THE DIGITAL ECONOMY ERA

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Abstract: Teaching content and methods of financial courses offered by our school are outdated, and the teaching quality is difficult to improve. With the in-depth development of the digital economy, development of information technologies such as the digital economy, artificial intelligence, and the Internet of Things has promoted the improvement of the efficiency of the financial industry, which has put new requirements and challenges for financial courses. In the era of the digital economy, financial courses need to strengthen innovation and reform, and cultivate talents with professional financial literacy and analysis capabilities. This article is based on the background of the digital economy, and analyzes the current situation and prominent problems of financial course teaching in the era of the digital from the perspectives of textbook updates, teaching content, teaching staff, and teaching resources. The methods of teaching innovation and teaching reform in the era of the digital economy are by integrating the background of the digital economy, aiming at improving the teaching effectiveness of financial courses in the era of the digital economy and the professional skills of students.
Keywords: Digital economy era; Finance; Teaching reform

1 INTRODUCTION

The purpose of courses is to cultivate professionals with a global vision, systematic mastery of financial knowledge and financial theory, professional skills in financial practice, strong social adaptability, and the ability work in banks, securities, insurance and other financial institutions, as well as government departments and enterprises. The content includes basic knowledge and skills in finance, economics, monetary, securities investment, insurance, etc., and carries out investment and financial management and risk control in securities, investment, trust, insurance and other industries. For example:, stock, bond yield analysis, risk assessment and investment management, property, life insurance sales, bank counter business, etc. With the rapid development of digital technology, are the following problems in the existing financial courses.

2 THE REALISTIC PROBLEMS EXISTING IN THE TEACHING OF FINANCIAL COURSES IN THE DIGITAL ECONOMY ERA

2.1 The Course Content Such As Data Technology and Digitization has not been Updated

The rapid development of digital economy has led to the continuous renewal of the knowledge system in related fields. However, the content setting of financial courses has not been able to keep up with this trend in, resulting in relatively backward course content, which can not fully reflect the latest theory and practice of the digital economy era. There is a lack of iteration of textbooks on in the digital economy era. Due to the small demand for textbooks, the need for a certain cycle of revision, and the lack of motivation of authors and publishers, most textbooks have a certain lag and have not been updated in time, which makes it difficult to meet the requirements of teaching. This will lead to a disconnection between theoretical knowledge learned by students and the actual situation, and insufficient knowledge acquisition of financial practice in the digital economy era. At the same time, due to the lag of content, there is a lack or outdated practical cases in the courses. Case analysis is a commonly used method in financial teaching. In the era of the digital economy, cases may have become outdated or lack representativeness. The lack of practical cases with the characteristics of the digital economy era will make it difficult for students to understand and the knowledge they have learned to practice.

2.2 Insufficient Integration of Data Skills and Governance Knowledge

Financial courses in the digital economy era need to integrate knowledge of data analysis and governance. However, some courses currently teach data skills and financial knowledge separately, lacking effective integration of the two. This makes it difficult for students to combine digital economy skills with governance theory and effectively apply them to practical governance problems. Under the traditional teaching mode, there is a significant lack of communication and interaction between teachers and students. In course teaching, the teacher's classroom lectures occupy a dominant position, and the teaching process is relatively monotonous. Under limited class hours, the main goal often becomes to complete the teaching tasks of the syllabus, resulting in poor teaching effectiveness. Although finance courses emphasize the combination of theory and practice, in practical teaching, they often focus too much on

imparting theoretical knowledge and overlook the importance of practical application. Students find it difficult to combine theoretical knowledge with practical cases, resulting in difficulties in understanding and applying the knowledge. Teachers often use a single teaching method, such as lecture method, case analysis method, etc., in the teaching process, lacking innovation and diversity. This not only makes students feel bored, but also fails to stimulate their interest and enthusiasm for learning.

2.3 The Interdisciplinary Collaboration of Teaching Staff Needs to be Strengthened

Financial courses in the digital economy era require teachers who possess both governance knowledge and familiarity with digital economy technology to teach. However, some universities may currently lack such faculty, resulting in uneven teaching quality. The requirements for teaching staff in finance courses in the digital economy era have indeed undergone significant changes. In this context, qualified teaching staff not only need to have a profound theoretical foundation and practical experience in finance, but also need to master digital economy technology and be able to apply data analysis and processing techniques to solve practical problems in finance. Financial teachers in the digital economy era need to have a deep understanding and mastery of the core concepts, mechanisms, laws and regulations of finance, be able to clearly articulate the theoretical framework of finance, guide students to understand the importance of finance, and be able to combine financial theory with practice to provide effective guidance for students. These teachers need to possess knowledge and skills related to the digital economy. They should understand the basic principles, processing techniques, and analytical methods of the digital economy, and be able to apply these technologies to the field of finance. For example, teachers can use the digital economy to analyze and evaluate corporate governance structures, shareholder behavior, executive incentives, and other issues, providing students with data-driven decision support and recommendations.

2.4 Insufficient Support for Digital Technology Facilities and Data Resources

The processing and analysis of the digital economy typically rely on advanced technological infrastructure and resource support. However, some schools or institutions are unable to provide students with sufficient technical support and practical opportunities due to funding, technology, and other reasons, which affects the learning effectiveness of the curriculum. The problem of insufficient technical facilities and resources in finance courses in the digital economy era mainly stems from the rapid development of digital economy technology and the high dependence of finance courses on technology. The digital economy era has put forward higher requirements for the technical facilities of finance courses. In order to effectively analyze and apply the digital economy, it is necessary to equip high-performance computers, storage devices, data processing and analysis software, etc. However, some schools or educational institutions may not be able to provide sufficient technological facilities due to funding, technology, and other reasons, resulting in poor course teaching effectiveness. At the same time, acquiring and integrating digital economic resources is also a major challenge. The finance course requires a large amount of practical data for case analysis, simulation exercises, etc., which are scattered across different institutions and platforms, making it difficult to obtain. And the integration, cleaning, and standardization of data is also a complex and time-consuming process that requires professional technical personnel to operate. If schools or institutions lack these resources, it will affect the practicality and teaching effectiveness of the curriculum. In addition, the update and iteration speed of digital economy technology is very fast, and new technologies and tools are constantly emerging. This requires teachers and technicians in finance courses to constantly learn and update their knowledge and skills to adapt to the development of technology. However, due to insufficient time and energy, some teachers and technicians may not be able to keep up with the pace of technology in a timely manner, resulting in relatively lagging technology applications.

3 REFORM MEASURES FOR FINANCIAL COURSE TEACHING IN THE DIGITAL ECONOMY ERA

3.1 Repositioning the Course Objectives of Finance Based on the Background of the Digital Economy Era

In the context of the digital economy era, the repositioning of the objectives of finance courses is particularly important. This repositioning requires close integration with the development trends of digital economy technology and the practical needs of finance, cultivating high-quality talents with data-driven thinking and innovation capabilities. The objectives of finance courses in the digital economy era mainly include: ① emphasizing data-driven governance decision-making ability. Data has become an important resource in finance in the digital economy era, and through data analysis, the current situation and problems of finance can be more accurately grasped; ② Emphasis is placed on cultivating students' mastery of digital economy analysis methods and technologies, enabling them to use data for financial decision-making, improving governance efficiency and effectiveness, and emphasizing the cultivation of students' innovation and practical abilities. Finance in the digital economy era faces many new challenges and opportunities, requiring continuous innovation and exploration Encourage students to propose new governance concepts and solutions, cultivate their innovation and practical abilities through practical projects, case analysis, and other methods, so that they can adapt to the development needs of the digital economy era; ④ Focusing on cultivating students' interdisciplinary and comprehensive qualities, finance involves knowledge from multiple disciplinary fields, including economics, management, etc. In the era of digital economy, finance needs to be integrated with fields such as

information technology and data analysis.

3.2 Integrating Knowledge of Digital Economy into Finance Education

Choose problems closely related to financial practice as teaching cases to ensure their authenticity and challenge. Integrate the latest theories and practices of the digital economy era to enable students to understand and master the application of the digital economy in finance. In the context of the digital economy era, the teaching content of finance courses needs to be optimized accordingly to adapt to the development of the times and practical needs. The following are several key aspects of optimizing teaching content: ① Introducing digital economy technology and analytical methods. Traditional finance courses may focus more on theoretical knowledge and case analysis, but in the era of digital economy, we need to integrate digital economy technology and analytical methods into teaching. This includes teaching students how to collect, organize, analyze, and interpret digital economy related to finance, as well as how to use this data to assist decision-making and problem-solving Strengthen the cultivation of data-driven decision-making ability. The decision-making process in finance requires sufficient information and data support. The curriculum should focus on cultivating students' ability to use the digital economy for financial decision-making, including how to identify key data, analyze data trends, and predict future trends. Through case analysis and practical operations, students can personally experience the process and effects of data-driven decision-making Emphasize the integration of interdisciplinary knowledge. Finance is a comprehensive topic involving multiple disciplines, including economics, management, law, information technology, and more. In the era of digital economy, this interdisciplinary characteristic is even more evident. Therefore, the curriculum should integrate knowledge and methods from different disciplines to form a comprehensive teaching content system, helping students broaden their knowledge horizons and improve their overall quality.

3.3 Innovation of Finance Curriculum in the Digital Economy Era Using PBL Method

Adopting PBL teaching method, students are guided by teachers to engage in self-directed and cooperative learning through group discussions, case analysis, field visits, and other methods. Combining online and offline teaching, utilizing online platforms to provide rich learning resources and interactive opportunities. In PBL methods, problem design is crucial. Teachers need to combine the characteristics of the digital economy era, design practical and challenging questions, and guide students to explore the practical problems of finance in depth. The questions can involve data-driven decision-making, risk management, stakeholder relationships, and other aspects, allowing students to experience the impact of the digital economy on finance through practical operations. Strengthen the cultivation of data analysis skills. In addition, in PBL teaching methods, teachers should focus on cultivating students' abilities in data collection, organization, analysis, and interpretation. They can guide students to use data analysis tools for practical operations, allowing them to improve their data analysis skills in the process of problem-solving. Finance is a multidisciplinary topic, and the application of digital economic technology also requires interdisciplinary knowledge background. In PBL teaching, teachers can encourage students to form interdisciplinary teams and work together to solve problems. Through communication and collaboration among students from different disciplinary backgrounds, knowledge integration and innovative thinking can be promoted. Meanwhile, utilizing digital economy technology to optimize the teaching process. In the digital economy era, teachers can use data analysis tools to monitor and evaluate students' learning processes in real time, understand their learning needs and difficulties, and adjust teaching strategies and provide personalized guidance. Teachers can also use online learning platforms and social media tools to interact and communicate with students in real-time, improving teaching effectiveness.

3.4 Enhancing the Teaching Staff of Finance Courses in the Digital Economy Era

Strengthen teacher training to enhance teachers' understanding and application ability of PBL teaching method. Introduce external experts with practical experience and academic background to participate in curriculum design and teaching implementation. Specifically, it includes: ① strengthening training in digital economy technology and financial theory. Teachers should possess solid knowledge of digital economy technology and financial theory in order to better integrate the two into teaching. By organizing regular training courses, seminars, or workshops, teachers can enhance their understanding and mastery of digital economy technology and financial theory Encourage teachers to participate in practical projects and research. Practical experience and research results are important supports for improving teaching quality. Teachers should actively participate in financial practice projects, gain a deep understanding of the actual situation and governance issues of enterprises, and conduct relevant research to explore new governance concepts and methods. Through practice and research, teachers can continuously update teaching content and improve teaching effectiveness Strengthen the introduction and cultivation of interdisciplinary teaching staff. Finance is a multidisciplinary topic that requires a cross disciplinary knowledge background. We should actively introduce outstanding talents with interdisciplinary backgrounds, encourage existing teachers to engage in interdisciplinary learning and research, and form a teaching team with multidisciplinary knowledge. Establish a mechanism for teacher collaboration and exchange. Collaboration and exchange of faculty between different universities, research institutions, and enterprises can promote knowledge sharing and the generation of innovative thinking. Cooperation and exchange with other institutions can be strengthened through establishing collaborative research projects, conducting faculty visits,

hosting academic conferences, and other means to jointly enhance the faculty strength Pay attention to the professional development and incentive mechanism of teachers. The professional development and incentive mechanism of teachers are important guarantees for enhancing the quality of teaching staff. A comprehensive teacher career development system should be established to provide promotion opportunities and career development paths for teachers. At the same time, by establishing teaching rewards, research achievement rewards, and other methods, teachers are encouraged to actively engage in teaching and research work, improving teaching quality and academic level.

3.5 Enrich Teaching Resources Such As Digital Technology and Data Elements

Establish a financial case library to provide students with rich learning materials. Strengthen cooperation with enterprises and industries, and provide students with practical opportunities and internship positions. Introduction of Digital Economy Case Library: Collect and organize digital economy cases related to finance, including successful and failed cases, for classroom teaching and case analysis. These cases can help students understand the practical application of digital economy in finance, enhance their practical skills and problem-solving abilities. Develop a digital economy experimental platform: Establish a specialized digital economy experimental platform for students to conduct data analysis and experiments related to finance. Through experiments, students can personally operate digital economic tools, explore the patterns behind data, and deepen their understanding of financial theory. Building online courses and learning resources: Utilizing digital economy technology to develop online courses and learning resources, such as video tutorials, e-books, online tests, etc. These resources can provide students with more learning options and help them learn financial knowledge anytime, anywhere. Strengthen school enterprise cooperation: collaborate with enterprises to jointly develop financial education resources. Enterprises can provide practical data and cases to help schools better understand the actual situation of finance. Meanwhile, schools can also provide theoretical support and talent cultivation for enterprises, achieving mutual benefit and win-win outcomes. Establish a teacher sharing mechanism: Establish a teacher sharing mechanism with other universities or research institutions, inviting experienced and knowledgeable teachers or experts to give lectures or lectures. This can provide students with a broader learning perspective and deeper academic guidance. Utilizing social media and online forums: Social media and online forums are important platforms for students to obtain information and exchange ideas. Teachers can use these platforms to publish teaching resources, organize discussions, and answer students' questions, and engage in real-time interaction with students.

4 CONCLUSION

Innovation and reform in financial education in the digital economy era are important components of modernizing educational management and are key to implementing it. Integrating the background concept of the digital economy era into finance courses can help promote the construction of finance courses and encourage college students to master the basic knowledge and practical abilities of finance in the digital economy era. On the basis of sorting out and analyzing the practical problems existing in the financial courses of the digital economy era, this study proposes reform measures for the teaching of financial courses in the digital economy era, namely repositioning the objectives of financial courses based on the background of the digital economy era, integrating knowledge content such as digital economy into financial teaching, innovating financial courses in the digital economy era, enhancing the teaching staff of financial courses in the digital economy era, and enriching teaching resources such as digital technology and data elements. Therefore, this study explores the reform of financial courses in the digital economy era, guiding students to combine digital economic technology with finance, thereby enhancing their comprehensive quality and truly realizing the digital development strategy. At present, in the process of exploring financial education in the digital economy era, the research on the connotation and application of financial education in the digital economy era started relatively late, and the research content still needs to be enriched, especially from theoretical research to management practice, which still has a long way to go. This study provides constructive suggestions and references for the reform of financial education in the digital economy era.

COMPETING INTERESTS

The author has no relevant financial or non-financial interests to disclose.

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