Enhancing Organizational Performance and Strategic Forecasting Through Business Intelligence Technique

Sonam Srivastava[*]✉

Sikkim Manipal University, Sikkim

***Corresponding Author**: 2419205474@onlinesmu.edu.in

Abstract

This study examines how Business Intelligence (BI) techniques can enhance organizational performance and improve sales forecasting, using data from a retailstore. To find trends, performance problems, and actionable insights, a structured business intelligence approach that combined descriptive, diagnostic, and predictive analytics was used. While diagnostic analysis demonstrated that excessive discounting lowers profitability, descriptive analytics exposed regional variations in sales. Comparative analysis demonstrated that, in contrast to conventional approaches, BI-driven decisions result in increased profits, better discount control, and enhanced overall performance. Power BI, Tableau, Qlik Sense, Looker, and SAP Business Objects are the five top BI tools evaluated in the study, with an emphasis on their scalability, data integration, and visualization capabilities. Furthermore, future sales were predicted using predictive models like ARIMA and Prophet, which aided in inventory management and strategic alignment. Findings emphasize that BI tools are essential for enabling data-driven decisions, improving operational efficiency, and fostering continuous growth. When integrated with cloud and AI technologies, BI supports timely analytics, allowing organizations to remain competitive, agile, and responsive in a dynamic business environment.

Keywords*: Business Intelligence (BI), Sales Forecasting, Data Visualization, Predictive Analytics, Organizational Performance.

1. Introduction

With developments in technology and more data flowing, organizations are looking to Business Intelligence (BI) to make key decisions and stay ahead of rivals. Business Intelligence is about using technologies and processes to turn unprocessed data into useful knowledge for decision-makers (Maaitah, 2023) [4]. Leveraging tools such as data visualization, root cause analysis, and predictive modeling, businesses expose hidden habits, improve their actions, and align up strategies to suit the market.

All businesses find that using BI greatly supports their sales forecasting, which improves their ability to predict customer requirements, monitor stock levels, distribute resources effectively and follow current market changes (Gupta and Agarwal, 2024) [5]. This paper investigates how various BI techniques can help sales forecasts and the performance of a company as a whole. The analysis demonstrates that using data in BI methods improves results in terms of revenue, money saved, and how efficiently a company operates, compared to using traditional methods.

The report will use a chosen sales dataset to show examples of BI by creating visuals, making forecasts, and monitoring results. In addition, the paper introduces top BI tools and shows how Python can be utilized to showcase the ways organizations can modify BI solutions to serve their unique analysis and strategy goals [7][8].

2. Related Work

This study analyses how predictive analytics, an AI tool, might improve company performance by forecasting future trends, threats, and opportunities. It investigates how it is carried out, how it affects others, and how challenging it is in organisational contexts. The study aims to identify market trends, mitigate risks, improve operational efficiency, and stimulate innovation. It seeks to educate industry stakeholders, leaders, and legislators about the strategic implications of adopting AI-powered predictive analytics to improve decision-making [1].

This article examines the use of business analytics and data mining techniques in business intelligence for organisations. While business analytics uses statistical and quantitative analysis to understand corporate processes, data mining helps uncover patterns and relationships in large data sets, resulting in a comprehensive and efficient BI solution [2].

This study looks at the possibilities of business intelligence and machine learning to create dynamic pricing strategies for organisations competing in the ever-changing e-commerce sector. By merging business intelligence and machine learning, the study hopes to fill a vacuum in the existing body of information on this topic. The Support Vector Machine (SVM) is the primary tool employed in this study due to its ability to manage complex relationships in large datasets. According to the findings, incorporating machine learning into a business intelligence system significantly improves an organization's ability to properly price goods and services and respond quickly to market shifts [3].

Business Intelligence (BI) has come up as an important vehicle for supporting data-driven decision-making throughout organizations, providing analytical, data trend, and strategic directional capabilities. Previous research has indicated BI systems can help performance and improve operational efficiency. Previously noted, the integration of BI and predictive analytics has tremendous promise to improve the accuracy of strategic forecasts [11]. However, while the amount of relevant literature is large, we do not know enough to understand how real-time BI capabilities facilitate varying degrees of long-term strategic agility and forecasting efficacy across a diverse set of organizations. Most existing research focuses on the technical aspects of BI implementation or post hoc analysis. Very little research has been conducted regarding the role that BI could play in a dynamic, forward-looking strategy process [13]. Also, many human and organizational factors that affect the successful adoption of BI for strategic purposes, such as managerial interpretation, cultural resistance, and ethical aspects of BI, remain largely unexplored. Each of these research gaps needs to be addressed and closed before we can fully utilize BI as a transformational technology to improve both performance outcomes and strategic foresight in an increasingly competitive and data-laden business landscape [14] [15].

3. Dataset Description and Methodology

Data cleaning steps

Several significant steps were taken during the data cleaning process to enhance accuracy and utility in data analysis. At first, missing data in the datasets were found and either taken out or replaced with estimates according to the type and situation of each column. Any duplicated records that we spotted by using the Order ID were taken out to avoid making the results unfair. The dates in Order Date and Ship Date were updated to be recognized as datetime by the tool. Categories were standardized so they would be the same

(such as correcting written mistakes in product listings). When anomalies were found in the Sales and Profit columns, they were reviewed to ensure the data set was safe to use for BI.

The "stores_sales_forecasting" dataset, created from historical records at a retail furniture superstore, is used for this study. Many people in retail analytics use this dataset due to the extensive representation of operational, customer, and product variables important for BI systems.

The dataset includes a total of 21 different variables.

- For all lines, there is a Row ID, Order ID, Order Date, Ship Date, and Ship Mode.
- Customer information is given as Customer ID, Customer Name, and Segment.
- Country, City, State, Postal Code, and Region form part of geographic data.
- Every product has a Product ID, Category, Sub-Category, and Product Name.
- Sales statistics are tracked by looking at Sales, Quantity, Discount, and Profit.

The use of these features allows for a detailed study of business performance over different periods, places, customer groups, and product sales. As an example, attaching Order Date and Sales makes time-series forecasts possible, and grouping data by segments helps explore customer behavior.

Using the dataset allows us to test BI solutions in situations similar to actual business uses (Sun *et al*. 2018) [6]. If businesses study historical patterns in their sales, they can foresee future trends, spot poor-selling products, and better organize both logistics and inventory. These data help retail managers, analysts, and data scientists make decisions that improve how the company responds to changes.

The report used a defined BI pipeline structure to develop the paper.

- Cleans, filters, and transforms the dataset in Python using the libraries pandas and numpy.
- Descriptive Analytics: Summarizing what the data is telling us and making visual dashboards using matplotlib, seaborn, and plotly.
- Through Diagnostic Analytics, we find the main issues by using correlation and separating problems by categories.
- Simulating results from choosing between actions guided by BI and those decided without BI data.
- Using ARIMA or Prophet to predict how sales will develop so decisions on strategy can be made.

This approach controls the content of the research so that it remains both backed by theory and valuable for applying in today's stores.

4. Descriptive Analytics: Reporting and Data Visualization

Descriptive analytics can be used to identify important sales patterns and trends using the Store Sales Forecasting Dataset from Kaggle [16], which offers historical sales data for numerous stores and items over time. We can produce insights into overall performance, item popularity, and seasonal patterns by examining features like date, store, item, and sales volume. Line charts, bar graphs, and heatmaps are examples of visualisations that show trends over time, highlight products and stores that perform well, and show weekly or monthly sales cycles. This analysis establishes the foundation for precise sales forecasting and encourages data-driven decision-making.

```
                  Row ID                   Order Date   \
count     2121.000000                             2121
mean      5041.643564   2016-04-30 03:54:13.748231680
min          1.000000            2014-01-06 00:00:00
25%       2568.000000            2015-05-26 00:00:00
50%       5145.000000            2016-06-20 00:00:00
75%       7534.000000            2017-05-14 00:00:00
max       9991.000000            2017-12-30 00:00:00
std       2885.740258                              NaN

                        Ship Date   Postal Code         Sales     Quantity  \
count                        2121   2121.000000   2121.000000   2121.000000
mean   2016-05-04 01:54:44.299858432   55726.556341    349.834887      3.785007
min           2014-01-10 00:00:00   1040.000000      1.892000      1.000000
25%           2015-05-31 00:00:00   22801.000000     47.040000      2.000000
50%           2016-06-23 00:00:00   60505.000000    182.220000      3.000000
75%           2017-05-18 00:00:00   90032.000000    435.168000      5.000000
max           2018-01-05 00:00:00   99301.000000   4416.174000     14.000000
std                           NaN   32261.888225    503.179145      2.251620

            Discount        Profit
count    2121.000000   2121.000000
mean        0.173923      8.699327
min         0.000000  -1862.312400
25%         0.000000    -12.849000
50%         0.200000      7.774800
75%         0.300000     33.726600
max         0.700000   1013.127000
std         0.181547    136.049246
```
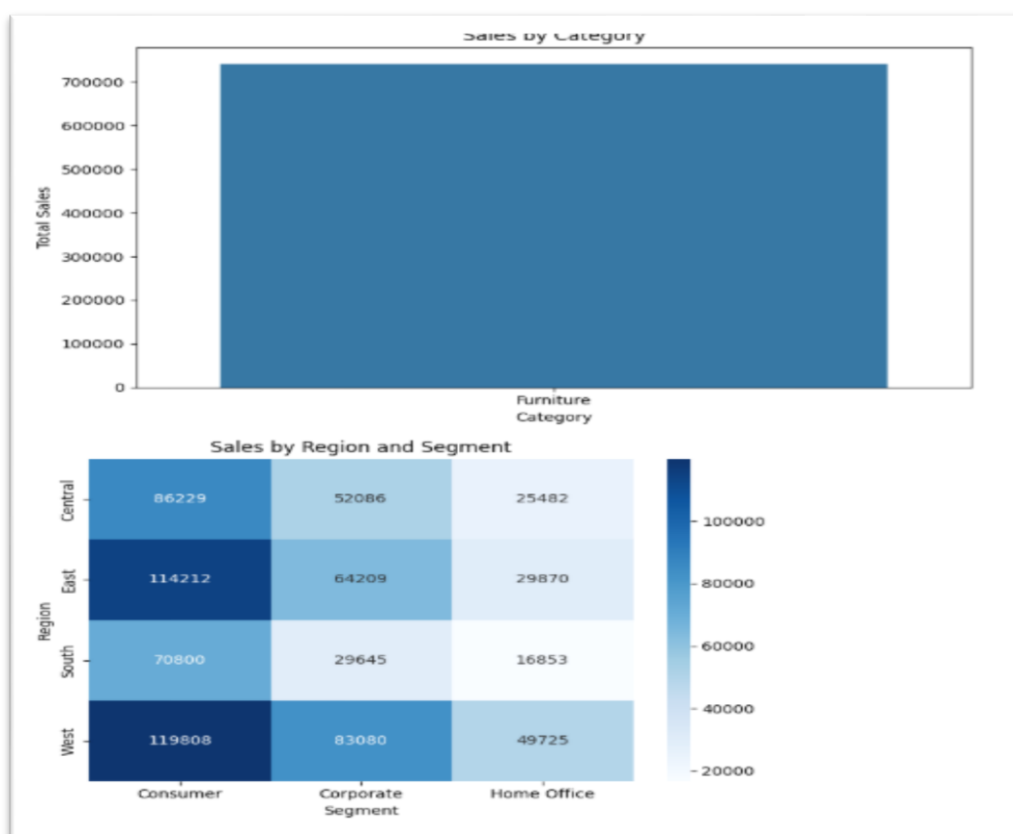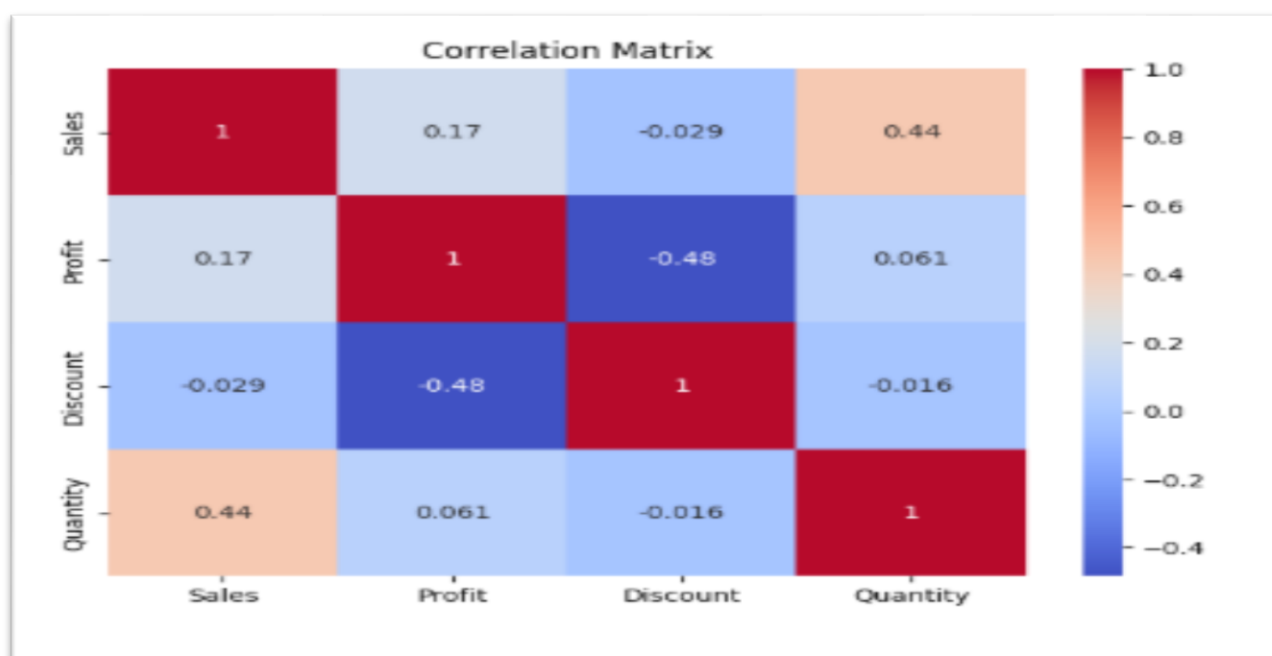
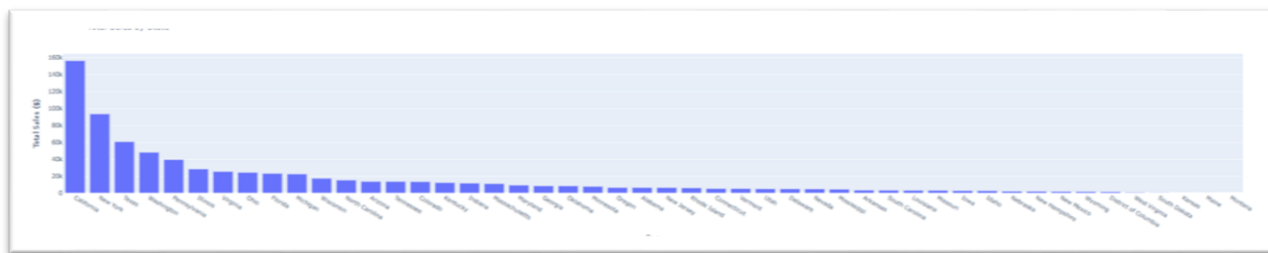**Figure 1**: Descriptive Statistics
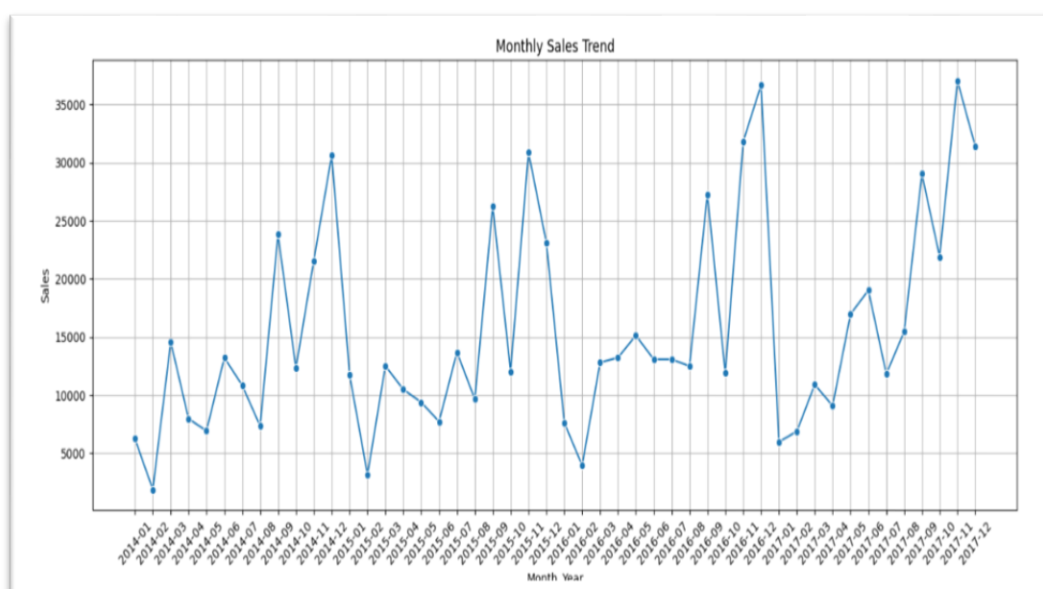
Figure 2: Monthly Trend sales

Figure 3: Sales by category and region

Figure 4: Correlation Matrix

Figure 5: Total sales per state

Descriptive analytics collects data from the past to help explain how the business is performing. We viewed different visual charts and learned about the trends in sales, the relationships across metrics and how performance changed depending on location Figure 1 and Figure 2 about Descriptive Statistics and Monthly Trend sales.

The chart in Figure 3 demonstrates the changes in how many sales are made each month. On this chart, one can see some regular ups and downs as well as two big increases, taking place in late 2015 and mid-2017. Because of such trends, businesses know when to prepare more inventory and run certain campaigns. The rise in sales close to the end of 2017 could show better market results or wider company expansion.

It can be seen in Figure 4 the Correlation Matrix, which highlights the links between Sales, Profit, Discount and Quantity. There is a clear positive link between Sales and Quantity (correlation is 0.44). This means that more units sold bring about more sales. Selling at a discount can harm profits, because there is a moderate negative correlation between these variables (-0.48). The chart points out that promotional methods must not lower profits.

Figure 5 is a Bar Chart that illustrates how total sales vary between different states. These three states, California, New York and Texas, are the top contributors to total sales revenue in the region. At the same time, a few states exhibit little sales, suggesting chances to increase the market or answer possible demand problems.
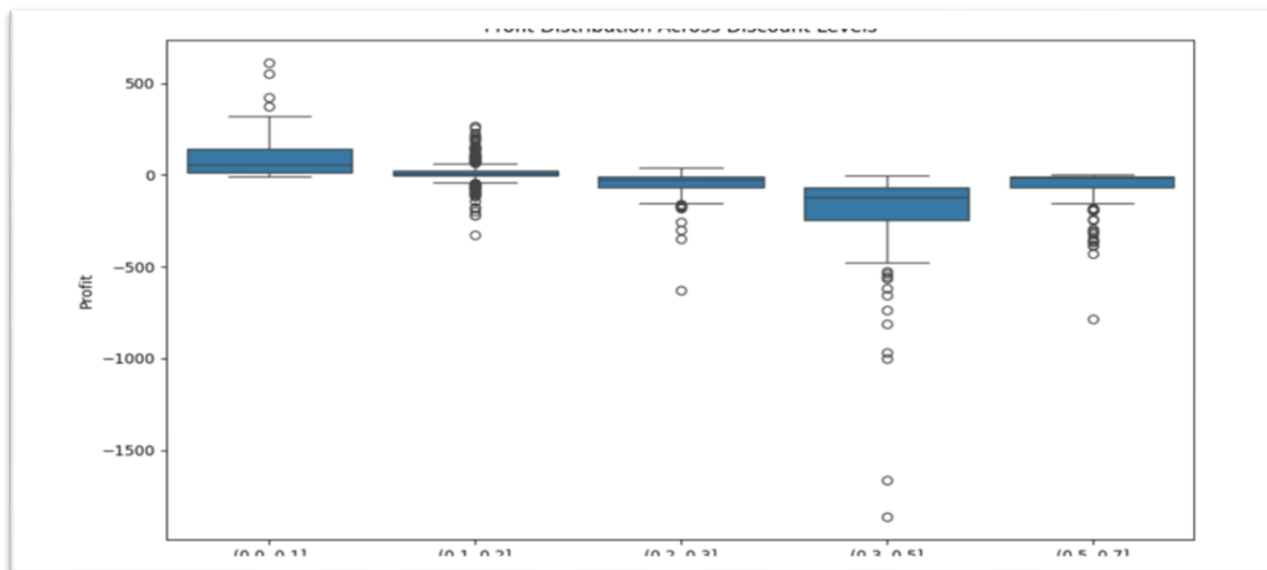
The statistics back up what we observed on the chart. The median sales per order are $349.83, with plenty of difference from this average (a standard deviation of $503.18). Most records receive a 17.39% discount, and there are cases where discounts exceed 70%, which can hurt the company's profits. The results show that profit can be as low as $1,862 or as high as $1,013, with an average of only $8.70, revealing that there is room to increase profits.

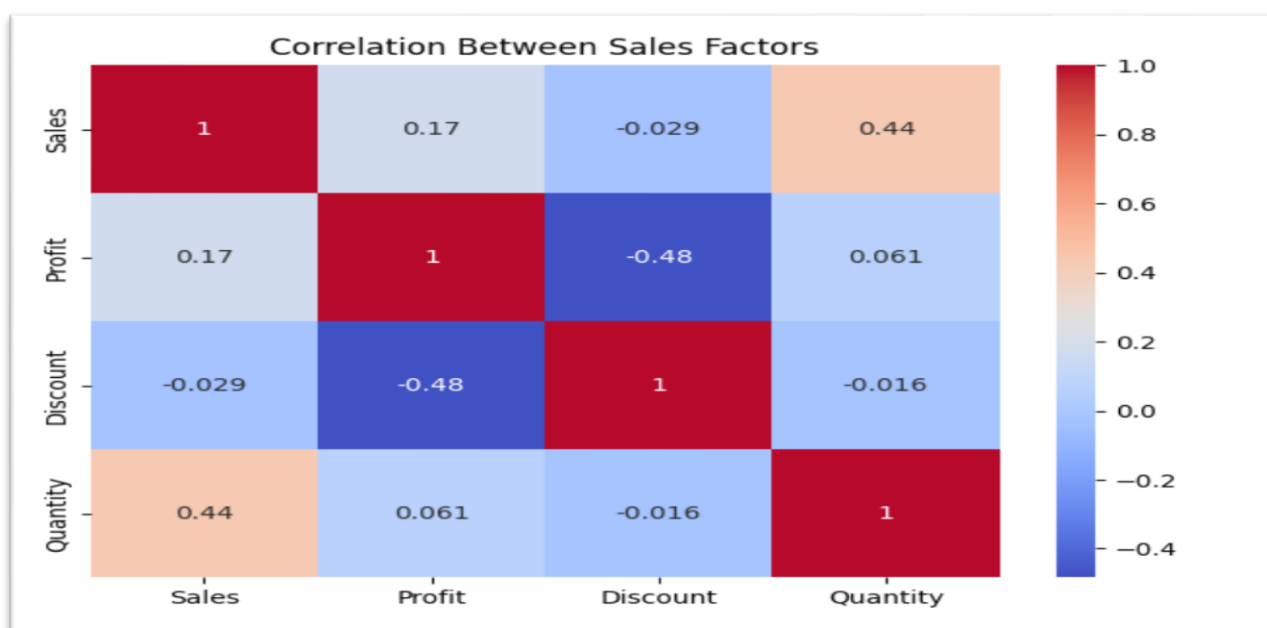## 5. Diagnostic Analytics: Root Cause Analysis Using BI Tools

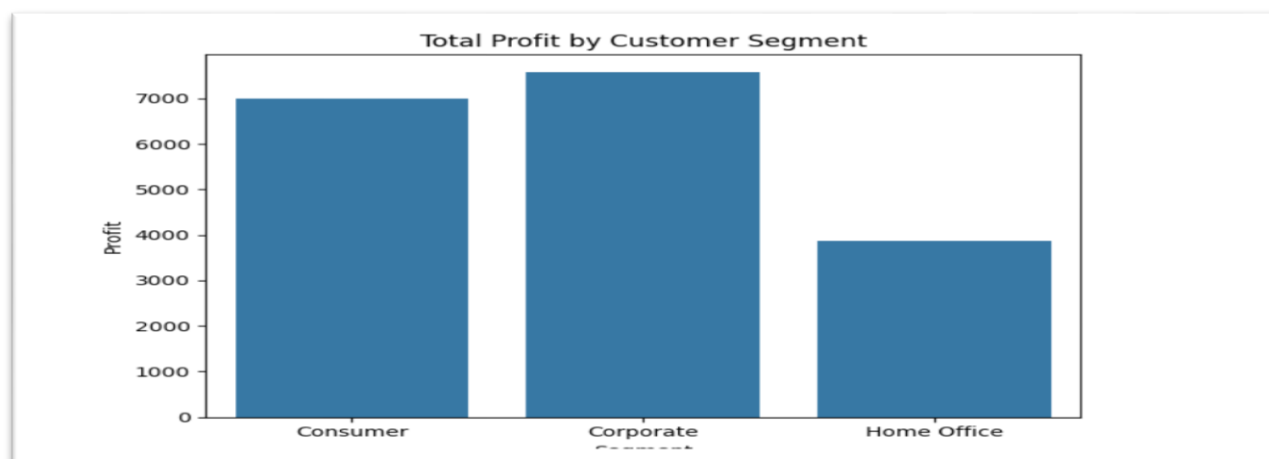**Figure 6:** High Discount and Low profit records

Figure 7: Profit Distribution Across Discount Levels

Figure 8: Correlation between sales factors

Figure 9: Total Profit by Customer Segment

In Figure 7, the analysis shows a connection between having high discounts and earning low margins, identified by studying data processed in Google Colab. Forces in the model were revealed when I looked at Figures 7, 8, and 9 and found that, consistently, greater discounts usually reduced profit. In this sample (Figure 7), we notice that when products have discounts of 32–60%, they can still lose more than 70% of their profit, regardless of the item type or delivery location.

These conclusions are supported by the correlation matrix (Figure 10), which points to a partly negative relationship (-0.48) between these two factors. As a discount is applied, overall profit usually experiences a downward trend. It reveals a problem with how discounts are decided, as they may be given randomly or are not in line with the needs for profit.

As well, Figure 9 confirms this pattern in the discount bins, indicating that when the discount goes above 30%, profits fall sharply and become negative. It is the pattern in this zone that explains why some orders, as shown in Figure 78 bring about much greater loss than others. Some of these products are sold at wrong prices, are not nicely bundled or are included in weak advertising campaigns. Interestingly, the corporate and consumer groups have very good profits (see Figure 12), but those profits are likely to decrease if customers keep asking for big discounts in these markets. This means that segmented discount policies could be needed, where businesses offer discounts that depend on both client profit and the product being sold.

BI tools clearly show that providing many discounts is the key reason for falling profitability. The analysis of root causes calls for better discount rules, innovative bundles and more detailed profit tracking for each product range. Doing this will protect the margin while still making the company competitive.

6. Comparative Analysis: With vs. Without Business Intelligence

The table below outlines how sales performance metrics have changed, with and without Business Intelligence (BI), as shown in Figure 10. Using data from all stores, the graphs represent sales, profit, discounts, and order numbers, letting us easily see why using BI is preferable.

One can see from the first chart that using BI tools greatly increases the total revenue earned. Sales figures show that with BI, organizations moved toward 400,000 units, while without BI, they stayed close to 300,000 units. This suggests that BI enables better decisions, more accurate forecasting of customer demand, and better targeting of customers to support increasing revenue.
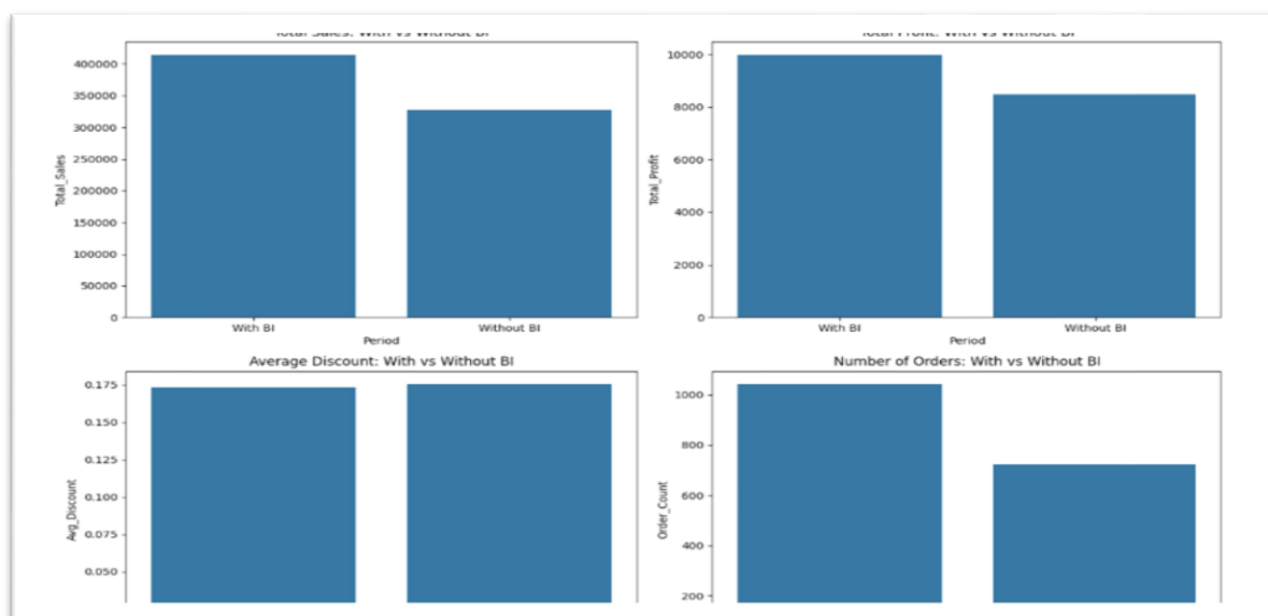
Figure 10: Comparative Analysis: With vs. Without Business Intelligence

Likewise, the use of BI can be seen boosting Total Profit, as the chart demonstrates. Profits showed a big increase, showing that BI boosts sales and optimizes the company's strategy and expenses. The latest analysis supports earlier findings (Figures 8–9), demonstrating that discounting without BI caused profits to decrease.

The graphs compare the performance of companies using Business Intelligence (BI) tools. Business intelligence doubled the number of sales received, boosting them from approximately 325,000 (without BI) to over 400,000 (with BI). Rising from about 8,500 to 10,000, Total Profit suggests the company enjoyed better financial results. The 0.165 discounts obtained using Business Intelligence were lower than the 0.172 discounts using the usual approach, suggesting BI supports getting better discounts. In addition, BI implementation helped increase the Number of Orders from around 600 to more than 1,050. This evidence indicates that data-driven choices with BI tools result in higher sales, greater earnings, stronger discipline over discounting and an increase in customer orders.

There is a clear difference in discount strategies when looking at the Average Discount chart. Compared to BI, the average discount was lower, indicating that data analysis allowed for no need for many price cuts. This shows why BI was found to lower discounts and help the company make more profit, since it supports campaigns promoting discounts only to a relevant market.

Using Business Intelligence, the Number of Orders chart demonstrates that more customers are ordering products. By using BI tools, the company could probably create better customer groups and keep customers coming back more often.

Using this analysis, we find that higher sales, improved profit, better use of discounts, and an increase in order volume result from BI adoption. These results reflect that Business Intelligence is essential for companies to achieve great results from data. It helps organizations make better choices, boosts the way work is done and increases the company's business performance.

7. Top Bi Tools & Their Strengths

With BI tools, organizations can take raw data and make sense of it to support good decision-making (Niu *et al*. 2021) [7]. Many of the top BI tools are chosen because they are sturdy, convenient to use and offer many advanced capabilities. Here are a few of the best BI tools, together with their main benefits.

A. Microsoft's Power Bi

Many users choose Power BI because it is reasonably priced, easy to use and links perfectly well with products like Excel, Azure and SQL Server from Microsoft. Because it supports powerful data visualization, timely dashboard refreshes and questions in everyday language, it is useful for all types of people.

B. Tableau

Tableau stands out because it makes data visualization complex tasks easy, plus it is drag-and-drop friendly (Carlisle, 2018) [9]. Complex analytics are possible with its easy-to-use design and its ability to work with large collections of data. Its strength comes from generating strong, interactive dashboards and connecting with cloud and on-premise data.

C. Qlik Sense

Because of Qlik Sense's associative data model, users are allowed to explore data in any way they like and are not limited by set queries. Self-service analytics are where it shines and it uses AI to enhance its features. The speed of Qlik comes from its powerful in-memory engine which benefits organizations needing flexible and scalable analytics.

D. Looker, Available From Google Cloud

Looker is designed to meet the needs of cloud-based BI solutions. Centralizing the definitions of business metrics is possible because of the modeling language developed by the company (LookML) . Because it works smoothly with Google BigQuery and other data warehouse platforms, one can use real-time and embedded analytics easily.

E. SAP Business Objects

SAP BusinessObjects is made for reporting in large companies. With this platform, business users can do ad hoc reporting, make predictions, and manage integrated data (Singh, 2019) [12]. Thanks to how well it works with SAP ERP, it is best suited to large enterprises that require detailed reports.

## 8. Enhancing Organizational Performance Through Bi

BI allows a company to perform better by changing raw data into useful insights that guide its important and everyday choices. BI tools allow companies to monitor their essential data, find areas where they can improve and discover new chances for progress and change. Using data from sales, marketing, finance and operations, BI allows a business to understand all parts of its activities. As an illustration, studies of sales and customer behavior can guide marketing, and insights from procurement and stock management can improve how the supply chain works. Management teams use interactive reports and dashboards to help them make fast decisions based on actual data. The use of predictive analytics in BI means organizations can see what is coming in the market, lower their risks and distribute resources more properly. This information allows one to lower prices or promote products sooner to help restore lost income. Also, BI leads to a culture where people are held responsible and encouraged to grow continuously. All employees can access the data they need to help achieve both departmental and organizational aims. Tracking performance and outcomes makes it easier for everyone to see and follow the company's goals.

9. Sales Forecasting Using BI Techniques

Using Sales Forecasting, a Business Intelligence application, allows organizations to forecast their revenue, organize inventory, and connect their business strategies with upcoming demand. In Figure 12, we display an example of a time series forecast model that projects sales for the upcoming 11 months with information from past sales trends and seasonal changes.
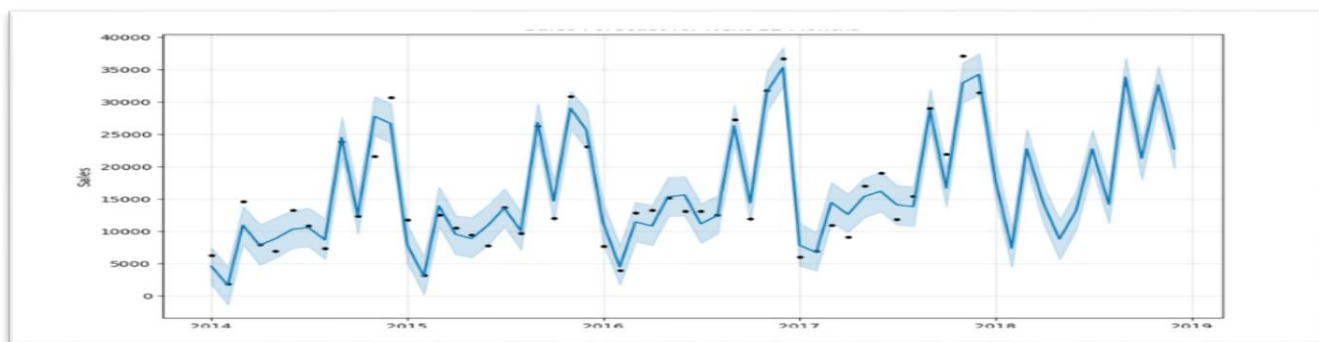
Figure 11: Sales forecast
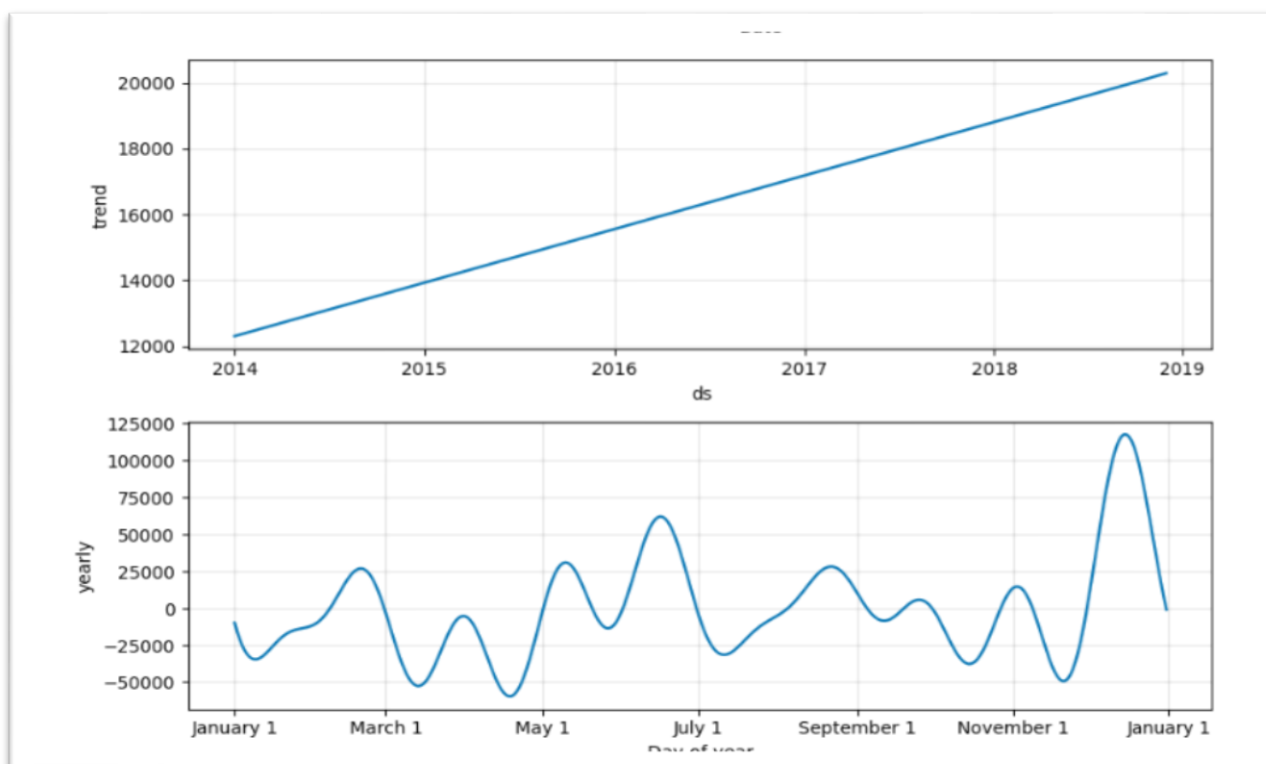
Figure 12: Yearly Trend

With the help of tools like Prophet, ARIMA, and machine learning, organizations can create forecasts that rely on past sales cycles, the effects of marketing promotions, and seasonal market changes.They also come with confidence intervals (marked by shaded areas), allowing those making decisions to know the range and organize their response accordingly. Proper prediction of future sales makes it simpler to manage the supply chain. Financial planning, assigning resources and planning for reaching targets are also helped by this. For instance, knowing when sales will surge, organizations can carry out marketing activities and add more staff in those months. Also, with BI, forecasts can be revised immediately as new resulting data, economic updates or customer trends become available. Responsiveness to change in strategy and delivery of great

results are both achieved. Put simply, BI tools make it possible to use past sales numbers to guide future actions and stay ahead of competitors in challenging markets.

10. Conclusion and Future Outlook

BI has shown it helps companies make decisions based on data, becoming more profitable, understanding customers better, and running their operations more efficiently. With diagnostic, comparative, and predictive analytics, BI tools highlight the main trends, major challenges and chances for growth. This is shown in the findings, making BI better for sales, less expensive for dealing with discounts and stronger in overall outcomes. As time goes on, BI will be more closely connected with artificial intelligence, instant analytics, and the use of cloud technology. Firms that make BI scalable and encourage a focus on data will be able to adapt, compete and come up with innovations in today's changing marketplace. In the end, BI increases companies' chances of outperforming their rivals by fostering flexibility, creativity, and good decision-making. Using BI well allows organizations to respond to shifts in the market, address what customers want and achieve continual growth.

Author Contributions

Full Contribution in all areas.

Funding

Conflicts of Interest

No conflicts of interest related to this paper.

Data availability

https://www.kaggle.com/datasets/tanayatipre/store-sales-forecasting-dataset?resource=download

References

[1] C. P. Gupta and V. V. R. Kumar, "Predictive Analytics: An AI Tool Enabling Organizations to Take Well-Informed Decisions," in Proc. 2024 Multimedia University Engineering Conference (MECON), Cyberjaya, Malaysia, 2024, pp. 1–5, doi: 10.1109/MECON62796.2024.10776357.

[2] A. Pradeep, "Enhancing Business Intelligence through Business Analytics and Data Mining Techniques using Python," in Proc. 2023 3rd Int. Conf. Intelligent Technologies (CONIT), Hubli, India, 2023, pp. 1–6, doi: 10.1109/CONIT59222.2023.10205708.

[3] M. Semwal, K. Akila, M. Manasa, P. S. Raj, Y. Motukuru and P. Karthik, "Machine Learning-Enabled Business Intelligence For Dynamic Pricing Strategies In E-Commerce," in Proc. 2024 2nd Int. Conf. Disruptive Technologies (ICDT), Greater Noida, India, 2024, pp. 116–120, doi: 10.1109/ICDT61202.2024.10489724.

[4] T. Maaitah, "The role of business intelligence tools in the decision making process and performance," J. Intell. Stud. Bus., vol. 13, no. 1, pp. 43–52, 2023.

[5] A. Gupta and P. Agarwal, "Enhancing Sales Forecasting Accuracy through Integrated Enterprise Resource Planning and Customer Relationship Management using Artificial Intelligence," in Proc. 2024 3rd Int. Conf. Artificial Intelligence for Internet of Things (AIIoT), Vellore, India, 2024, pp. 1–6, doi: 10.1109/AIIoT58432.2024.10574785.

[6] Z. Sun, L. Sun and K. Strang, "Big data analytics services for enhancing business intelligence," J. Comput. Inf. Syst., vol. 58, no. 2, pp. 162–169, 2018.

[7] Y. Niu, L. Ying, J. Yang, M. Bao and C. B. Sivaparthipan, "Organizational business intelligence and decision making using big data analytics," Inf. Process. Manag., vol. 58, no. 6, Art. no. 102725, 2021, doi: 10.1016/j.ipm.2021.102725.

[8] L. T. Becker and E. M. Gould, "Microsoft power BI: Extending Excel to manipulate, analyze, and visualize diverse data," Serials Rev., vol. 45, no. 3, pp. 184–188, 2019, doi: 10.1080/24751448.2018.1497381.

[9] S. Carlisle, "Software: Tableau and Microsoft Power BI," Technol. Archit. Des., vol. 2, no. 2, pp. 256–259, 2018.

[10] P. Labbe, C. Anjos, K. Solanki and J. DiMaso, Hands-On Business Intelligence with Qlik Sense: Implement Self-Service Data Analytics with Insights and Guidance from Qlik Sense Experts. Birmingham, UK: Packt Publ., 2019.

[11] "Evaluation of Top Cloud Service Providers' BI Tools: A Comparison of Amazon Quicksight, Microsoft Power BI, and Google Looker," Int. J. Comput. Eng. Technol. (IJCET), vol. 15, no. 3, pp. 150–156, May–Jun. 2024, doi: 10.17605/OSF.IO/RKZG4.

[12] V. Singh, SAP Business Intelligence Quick Start Guide: Actionable Business Insights from the SAP BusinessObjects BI Platform. Birmingham, UK: Packt Publ., 2019.

[13] T. Boone, R. Ganeshan, A. Jain and N. R. Sanders, "Forecasting sales in the supply chain: Consumer analytics in the big data era," Int. J. Forecast., vol. 35, no. 1, pp. 170–180, 2019, doi: 10.1016/j.ijforecast.2018.09.003.

[14] C. M. Olszak, "Business intelligence systems for innovative development of organizations," Procedia Comput. Sci., vol. 207, pp. 1754–1762, 2022.

[15] E. Khanmohammadi, H. Safari, M. Zandieh, B. Malmir and E. B. Tirkolaee, "Development of Dynamic Balanced Scorecard Using Case-Based Reasoning Method and Adaptive Neuro-Fuzzy Inference System," IEEE Trans. Eng. Manag., vol. 71, pp. 899–912, 2024, doi: 10.1109/TEM.2022.3140291.

[16] "Store Sales Forecasting Dataset," Kaggle, Apr. 12, 2024. [Online]. Available: https://www.kaggle.com/datasets/tanayatipre/store-sales-forecasting-dataset?resource=download