Enhancing Organizational Performance and Strategic Forecasting Through Business Intelligence Technique

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Abstract

In this paper, show how BI applications can lead to sales forecasting and organizational performance improvements based on the case of a retail store. To detect patterns, performance issues and actionable results, a relatively simple business intelligence model based on descriptive, diagnostic and predictive analytics was applied. Although descriptive analytics revealed regional sales differences, diagnostic analytics found that too much discounting reduces profit. The comparison analysis confirmed that the proposals enable more profit, better discount management and improved performance in general when BI-based decision making is applied versus traditional methods. The present work evaluates five leading BI tools, namely Power BI, Tableau, Qlik Sense, Looker and SAP Business Objects based on their scalability, data integration and visualization features. In addition, future sales were predicted with the help of predictive models such as ARIMA, Prophet, etc., which contributed to inventory control and strategic alignment. The results highlight that BI solutions are core enablers of data-driven decision making, operational efficiency, and even continuous growth. With cloud and AI integration, BI provides real-time analytics to enable organizations stay competitive, agile, and responsive in today's business landscape.

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

1. Introduction

With the advances of technology and more data available, organizations are turning to Business Intelligence (BI) to inform decisions and gain an edge over competitors. Business Intelligence (BI) refers to a set of technologies and processes that transform raw data into meaningful information for decision makers (Maaitah, 2023) [4]. Using a range of tools such as data visualization, root cause analysis and predictive modeling, companies reveal hidden patterns that enable them to adapt to the market-place by improving what they do and, where necessary, matching their strategies.

All the enterprises have realized that their sales forecasting is immensely supported by employing BI which leads to a better prediction of the customer needs, stock monitoring, efficient distribution of resources, and also tracking of the current market advancing (Gupta and Agarwal, 2024) [5]. This paper examines to what extent different BI techniques can support the sales forecasts and the performance of a firm overall. The findings show that the use of data in BI-based approaches leads

to better performances in terms of income, cost reduction, and organizational efficiency when compared to traditional methods.

The report will make use of a selected sales dataset to illustrate examples of BI by building visualizations, predicting, and monitoring results. This paper also presents leading BI software tools and demonstrates how Python can be used to demonstrate how organizations can tailor BI solutions to the specific needs of their analytics and strategic objectives [7][8].

2.0 Related Work

This research evaluates how predictive analytics, as an AI instrument, could lead to an increased firm performance by predicting future trends, risks, and possibilities. It studies what is done, what is done to others, and what is done to do it in organisation. The purpose of this study is to recognize market dynamics, reduce the risk, enhance operational efficiency, and encourage innovation. It is intended to educate representatives of industry, leaders and policy makers on the strategic consequences of leveraging an AI-enabled predictive analytics solution for the potential to enhance decision-making [1].

In this paper, the application of business analytics and data mining techniques in business intelligence for the enterprises is discussed. Although business analytics applies statistical and quantitative analysis to business processes, and data mining discovers patterns and relationships in large data sets, together these two methods provide a holistic and powerful BI solution [2].

This paper investigates the potential of BI and ML to develop effective dynamic pricing models for businesses operating in the highly volatile e-commerce market. By integrating the techniques of business intelligence (BI) and machine learning (ML), this research intends to contribute to a gap in prior research on this subject matter. In this study the primary method used is the Support Vector Machine (SVM) because of its capacity for capturing complex relations within large datasets. The results show that the integration of machine learning in to business intelligence system is crucial to propelling firm's ability to accurately price its products and services as well as responding promptly to changing market conditions. [3]

Business Intelligence (BI) is emerging as a solid instrument for fostering analytical and data trending abilities with a strong influence on the organization's decision-making process at all levels of the applications, from tactical to strategic. Past studies have demonstrated that BI tools can enhance performance and increase operational efficiency. As addressed earlier, the confluence of BI and predictive analytics entails great potential in enhancing the precision of long-term strategic predictions [11]. Nonetheless, although there is a considerable amount of pertinent literature, we are still quite unsure as to how real-time BI supported capabilities enable different versions of long-term strategic agility and forecasting effectiveness within an assortment of organizations. The prevailing body of work considers predominantly the technical aspects of BI implementation or ex ante analysis. Little investigation of the extent to which BI can influence a dynamic, forward-looking strategy process has been carried out [13]. Furthermore, numerous human and organisational factors that influence successful adoption of BI for strategic use, including managerial interpretation, culture resistance and ethical dimensions of BI, are for the most part unexplored. Each of these strands of research gaps must be addressed and closed to fully exploit BI as a transformative technology leveraging both performance outcomes and strategic foresight in an increasingly competitive and data-laden business environment [14] [15].

3.0 Dataset Description and Methodology

3.1 Data cleaning steps

During the cleaning process, the following major procedures were conducted for ensuring the accuracy and the usability in analysis of the data. At the beginning, the missing values in the datasets were detected and deleted or imputed by means of the type and the scenario of each column. Any duplicate records that we found around using the Order ID hundred percent out of them, so it doesn't make the result biased. The dates in Order Date and Ship Date fields were modified to be datetime type recognized by the tool. Categories were normalized to be the same (for example fixed spelling errors in product names) and so on more. When outliers were detected in the Sales and Profit columns, they were examined to make sure the data set is reliable for BI.

For this study, we utilize the "stores_sales_forecasting" dataset, which is derived from past transactions of a retail furniture superstore. This dataset is popular among retail analytics professionals as it has a comprehensive set of operational, customer, and product variables that are ideally suited to 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.

4.0 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.
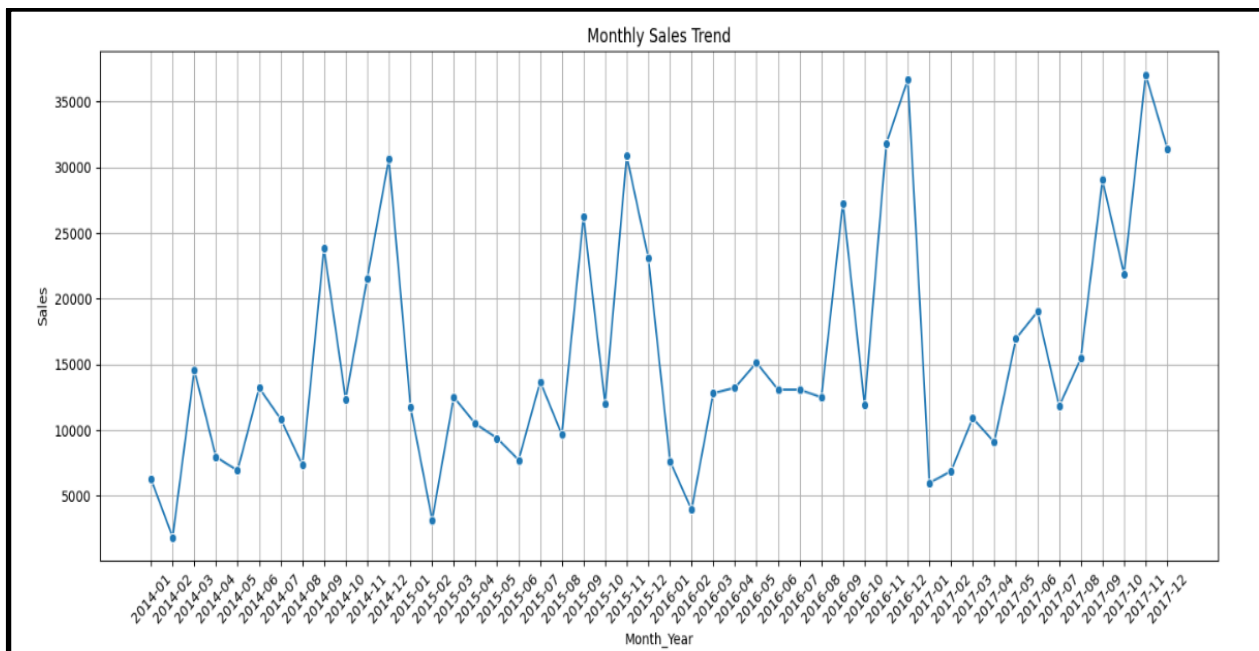

Figure 1: Descriptive Statistics

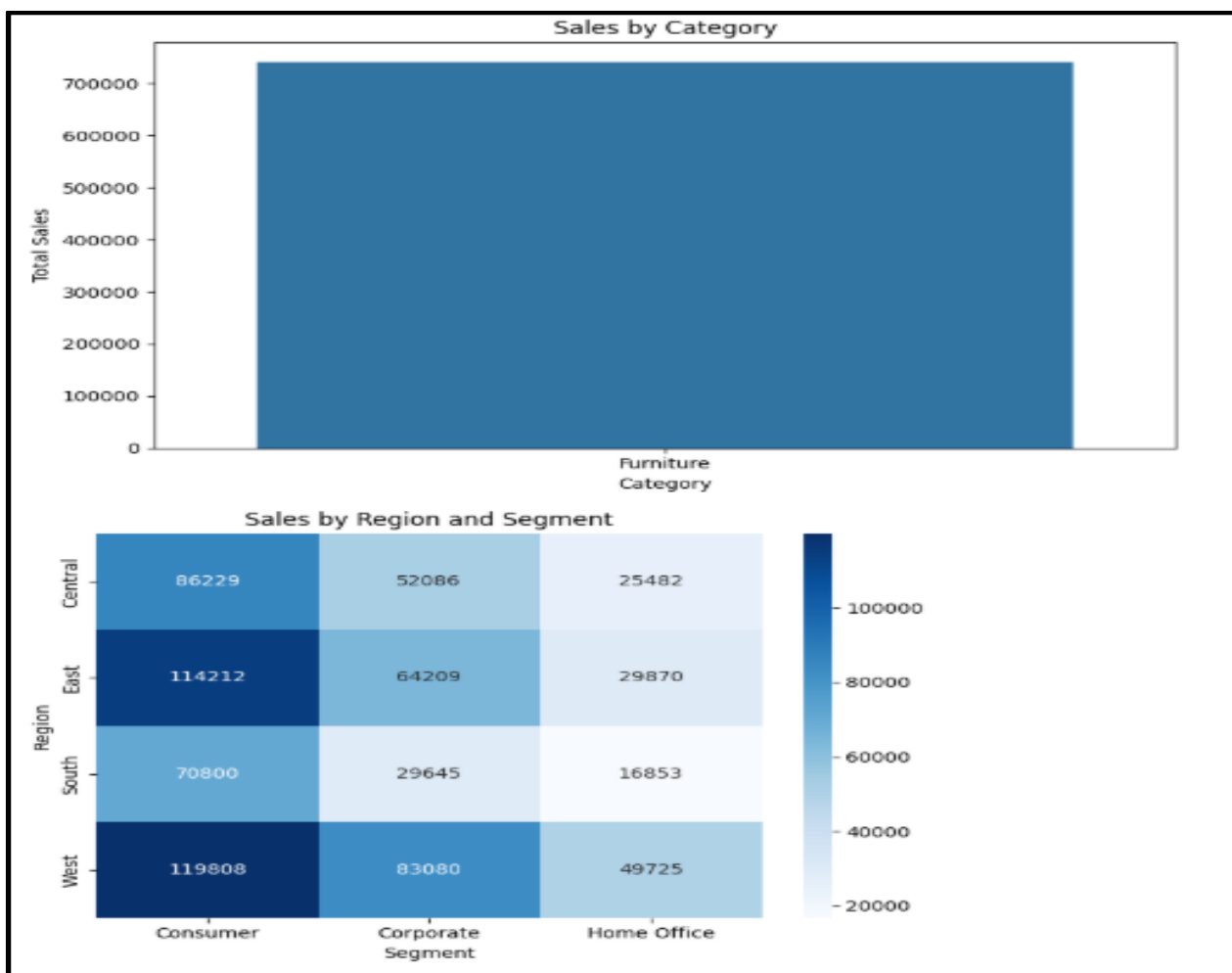**Figure 2: Monthly Trend sales**

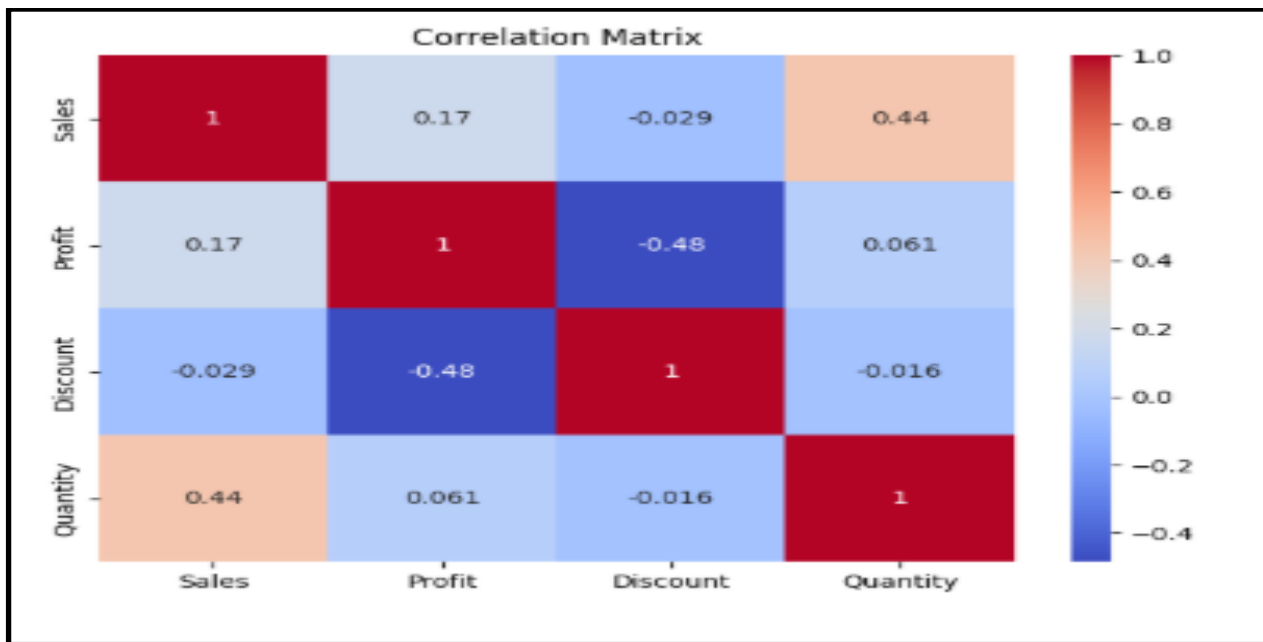**Figure 3: Sales by category and region**
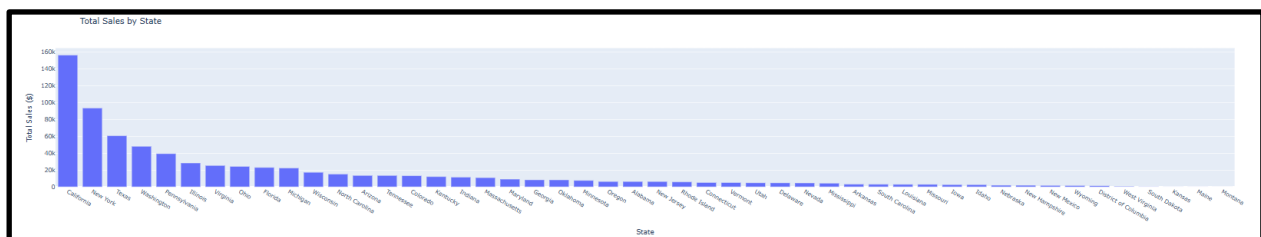
Figure 4: Correlation Matrix

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.

5.0 Diagnostic Analytics: Root Cause Analysis Using BI Tools

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High Discount & Low Profit Records:
        Order ID                               Product Name      \
2   US-2015-108966       Bretford CR4500 Series Slim Rectangular Table
7   US-2015-150630   Riverside Palais Royal Lawyers Bookcase, Royal...
9   CA-2016-117590   Electrix Architect's Clamp-On Swing Arm Lamp, ...
10  CA-2015-117415   Atlantic Metals Mobile 3-Shelf Bookcases, Cust...
19  US-2017-118038                       6" Cubicle Wall Clock, Black

     Discount   Profit_Margin
2        0.45       -0.400000
7        0.50       -0.540000
9        0.60       -0.775000
10       0.32       -0.088235
19       0.60       -0.600000
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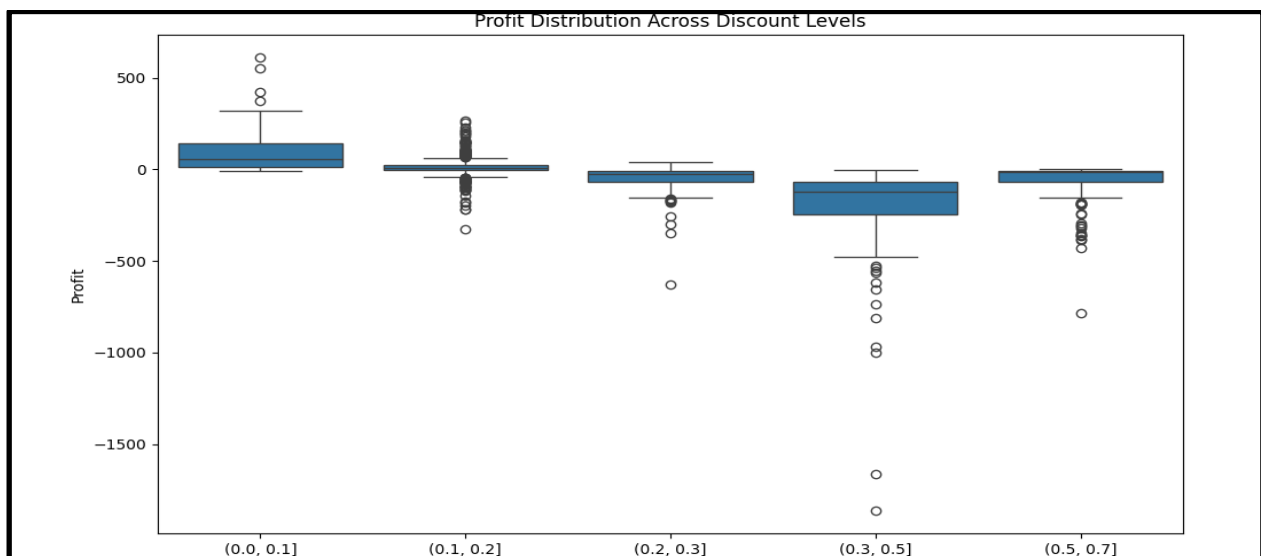
Figure 6: High Discount and Low profit records

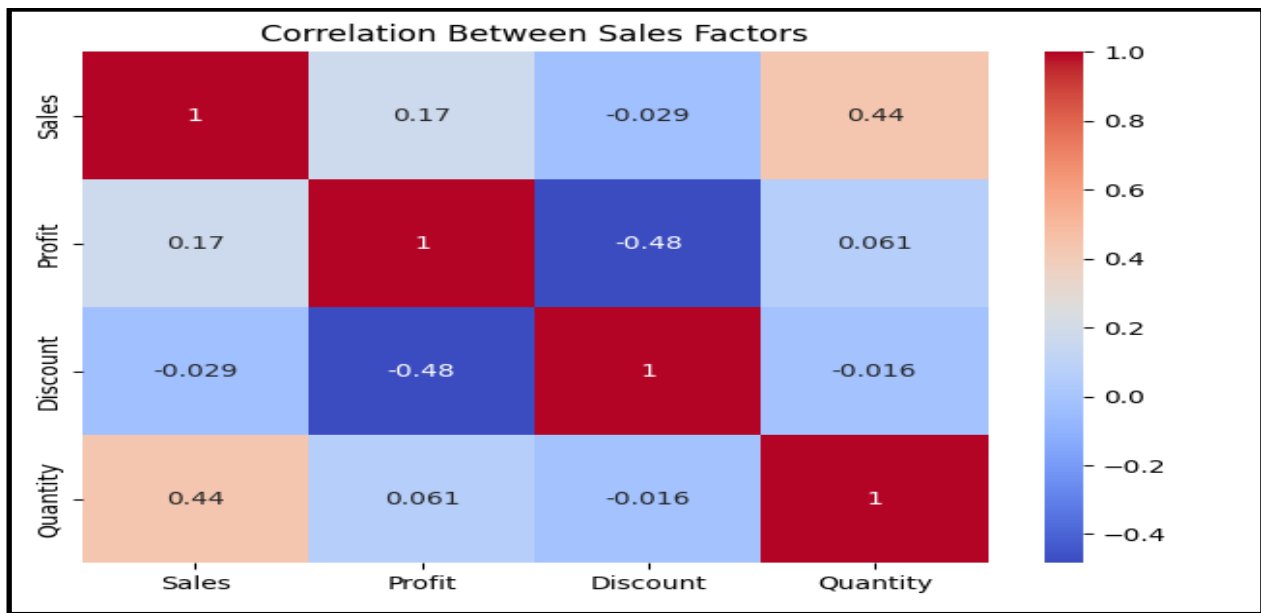**Figure 7: Profit Distribution Across Discount Levels**

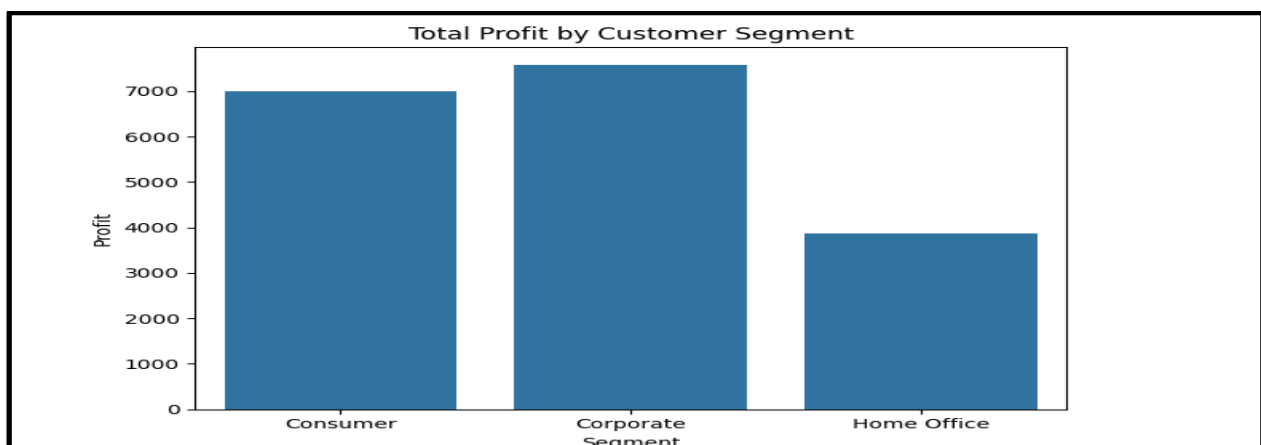**Figure 8: Correlation between sales factors**

Figure 9: Total Profit by Customer Segment

In Figure 7, the result indicates an association between a high discount and a low margin, which is obtained by analyzing the data that is computed in Google Colab. I discovered forces latent in the model when I examined Figures 7, 8 and 9 and saw that, without fail, higher discounts decreased profits. In this (Figure 7) sample, observe that products which are discounted by 32–60% still can lose more than 70% of their profit whether it is a type of item or the place to deliver. 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.

6.0 Comparative Analysis: With vs. Without Business Intelligence
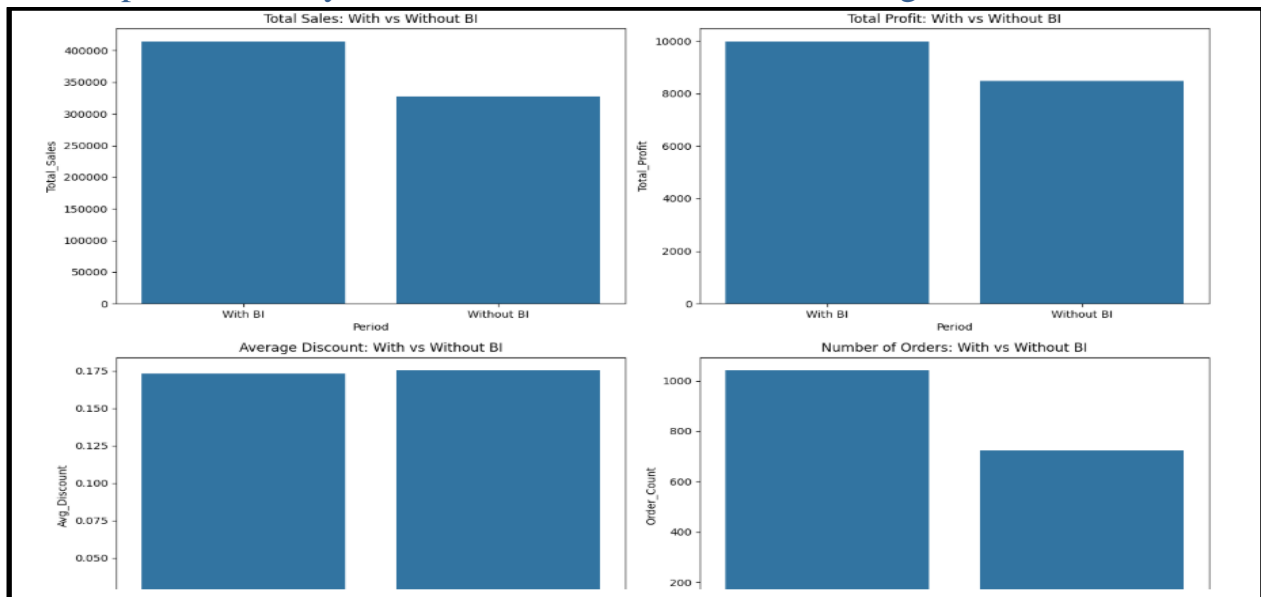

Figure 10: Comparative Analysis: With vs. Without Business Intelligence

The table shows Δ performance in the sales of metrics with or without Business Intelligence (BI), as follows in Figure 10. The charts, generated using data from all the stores, show sales, profits, discounts, and the number of orders, so it's easy to understand why BI is preferred.

From the first graph, it's clear that income overall is significantly higher when employing BI tools. These sales numbers indicate that with BI, the companies averaged almost 400,000 units, while the companies without BI hovered around 300,000 units. This would indicate that better decisions can be made, and that customer demand can be more accurately predicted, and more effectively targeted customers to help drive revenue growth are also available through BI.

The impact of BI on Total Profit is similarly marked, if you take a look at the chart. The profit demonstrated huge increment which proved that BI increases the sales of company and also perfect the strategy of company and the cost. Our new analysis corroborates our earlier findings (Figures 8–9) that discounting without BI resulted in a decrease in profits.

The charts illustrate the-compare the success of companies with different use of Business Intelligence tools. Business intelligence doubled the amount of sales obtained, raising them from around 325,000 (without BI) to more than 400,000 (with BI). Going up from around 8,500 to 10,000 the Total Profit indicates the company made more money. The 0.165 discounts achieved by Business Intelligence were better than the 0.172 discounts obtained in the traditional manner, implying that BI can assist in acquiring better discounts. Further, the application of BI enabled an increase in the Number of Orders from approximately 600 to in excess of 1,050. This evidence leads us to believe

that the data-led decisions delivered by BI tools have higher sales, more earnings, stronger discipline over discounting and more customer orders.

There's a marked difference between the discount patterns across this chart for Average Discount. The average discount was lower than those of BI which shows that the data analysis led to fewer cuts in prices. This explains why BI was found to decrease discounts and increase company profits, as it backs up the campaigns that reward more discounts exclusively to a relevant market.

While using Business Intelligence, Number of Orders helps show that the Number of Customers who chose products increased. With the aid of BI tools, it's possible that the company can build more effective customer clusters and make customers return more frequently. 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.

7.0 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.

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.

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.

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.

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.

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.

8.0 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.

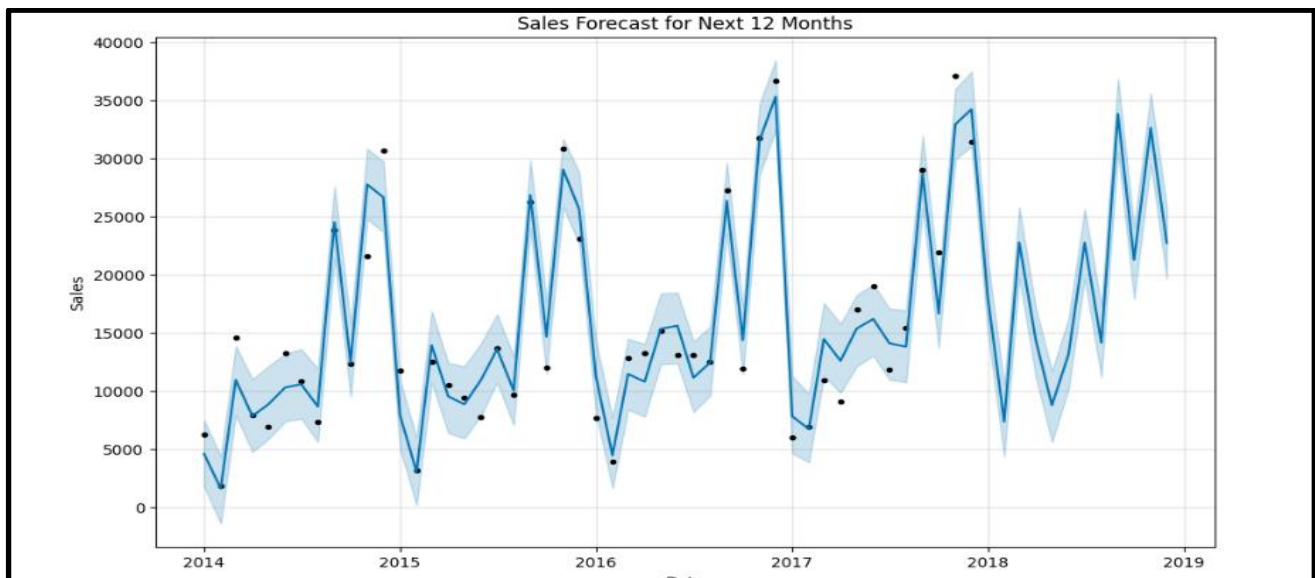## 8.0 Sales Forecasting Using BI Techniques
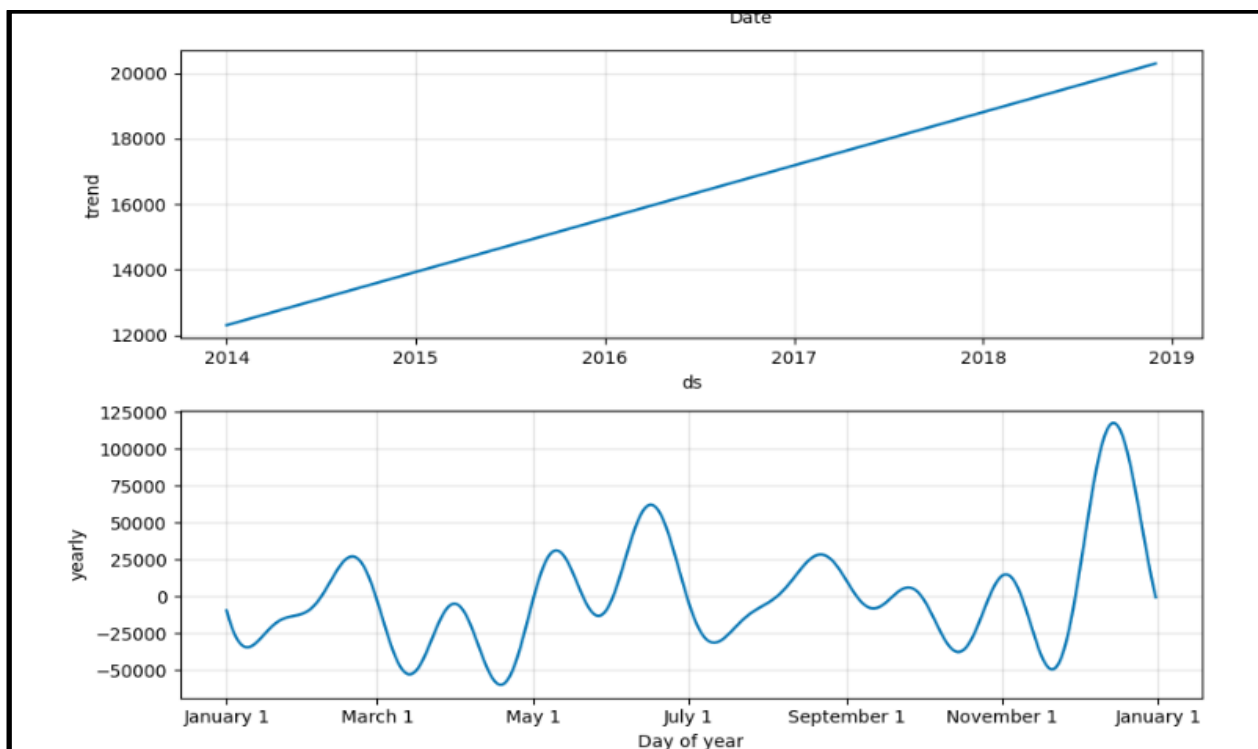

Figure 11: Sales forecast

Figure 12: Yearly Trend

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.

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 work

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

All the work for this study was carried out by Sonam Srivastava, including conceptualization, methodology, data collection, analysis, interpretation, and manuscript preparation.

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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

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