INVENTORY MANAGEMENT USING IBM COGNOS ANALYTICS

Final Report

Submitted as a part of

DATA ANALYTICS EXTERSHIP PROJECT

to

SmartBridge

By

SHUBHADIP CHAKRABARTI

VIT CHENNAI

Completed Under the Guidance of

Uma Rani

Completed During

March – June 2022

TABLE OF CONTENTS

CHAPTER NUMBER	SECTION NUMBER	TITLE	PAGE NUMBER
1		INTRODUCTION	4
	1.1	PREAMBLE	4
	1.2	OVERVIEW	5
	1.3	PURPOSE	6
2		LITERATURE SURVEY	7
	2.1	EXISTING PROBLEM	7
	2.2	PROPOSED SOLUTION	8
3		THEORITICAL ANALYSIS	9
	3.1	BLOCK DIAGRAM	9
	3.2	HARDWARE AND SOFTWARE REQUIREMENTS	10
4		EXPERIMENT INVESTIGATION	11
	4.1	IBM COGNOS PLATFORM ANALYSIS	11
	4.2	CALCULATION	12

5		METHODOLOGY	13
6		FLOWCHART	17
7		RESULT	18
8		ADVANTAGES AND DISADVANTAGES	26
		DISVANTAGES	26
		ADVANTAGES	28
9		APPLICATIONS	29
10		FUTURE SCOPE	30

CHAPTER 1

INTRODUCTION

1.1 Preamble

Store refers to an establishment where merchandise is sold, usually on a retail basis. Retail store links a consumer product to a customer in the supply chain management system. It may be identified as grocery stores, electronics store, shoe store, medicine store, etc., depending on the product dealt therein. Department store, a type of retail store, offers a wide range of consumer goods under same shade. In other words, a retail store, irrespective of its type, has to handle diverse range of products involving unique inventory issues targeted at distinct customers. Further, in an organizational setup, normally a stores department is held responsible to effectively handle the Product requirements of the said organization. In this context, the inventory management of the said organizational stores department attains immense importance. This essentially necessitates a robust inventory management system.

Inventory relates to the stock of products in a store. It is necessary to maintain this stock on hand to ensure that any customer demand is reasonably met at any point of time. Sometimes, it may be necessary to maintain larger inventory in case of anticipated enhanced demand. In other words, a buffer inventory may have to be maintained to meet any unexpected rise in demand in case of a dynamic demand situation. This buffer may at times help a store in meeting a situation where the supplier fails to supply products of intended quantity in time. On the other hand, excess inventory may affect the economic sustenance of the store adversely.

Thus it is necessary to have judicious inventory of store for its overall benefit.

With the entirety of the Supply Chain depending majorly on the sectors like Inventory Management among others, it becomes important to gain proper insights into the past sales and revenue generated from those sales within the organization. These insights gained would enable the organization to strategize and plan accordingly. With competition increasing every single moment, the survival and growth of the company solely depends on how fast the organization is able to generate and review those necessary insights. Hence, it requires the involvement of necessary tools and services that would enable the organization to gain those necessary insights in a faster way.

1.2 Overview

During this Externship period, I was expected to use data analytics tools and services to generate necessary insights from the sales of an organization. The above stated objective was met by visualizing all the aspects of the supply chain that contributed majorly to the development of necessary insights on the sales track records of the organization. The past trend data was also used to forecast the possible growth in the sales in the near future. This forecasted data helped the organization provide the necessary insights for the growth of the organization.

The dataset used in this Externship project corresponds to the Retail Sales data for an organization. The dataset has four attributes. The attributes are namely, Date, Sales, Stocks and Price. The date column corresponds to the date of sales, price and stocks. The sale, stocks and price columns corresponds to the sales track records of the organization.

The information present in this dataset was used to gain necessary insights into the Sales track records within the organization. The data was also used to generate forecasts to help the organization take decisions accordingly.

1.3 Purpose

The main purpose of the project was to generate necessary insights from the retail sales of an organization. The dataset procured to gain necessary insights for an organization was used to perform visualization among various aspects of their sales track records. The visualization helped the organization understand the present state of the company in a very pleasing way. The data was also used to forecast the possible growth in the sales in the near future. This forecasted data also helped the organization provide the necessary insights for the growth of the organization. Hence, the overall purpose of the project was to use data analytics tools and services to gain useful information from the data provided to us and put the information in a very pleasing way.

CHAPTER 2

LITERATURE STUDY

1.1 Existing Problem

In this existing system where there are no tools and services used for gaining insights into the data to support the useful information generation process provides a following major challenges:

a) The data usually present in CSV forms are hard to interpret and draw any necessary conclusions.
b) The data present in these databases are present in huge amounts, so getting useful insights become very hard.
c) Visualizing the trends/patterns present in such data becomes nearly impossible.
d) Forecasting based on past trends becomes a very hard task to achieve.
e) Time Intensive Process
f) Requires huge investment of efforts into the process.
g) Difficult to identity the possible errors and outlier values.
h) Even after investing huge efforts, it might not always lead to correct interpretations. Incorrect interpretations might lead to greater damage to the company.

With the limitations of the present system highlighted, it becomes pertinent to eliminate these drawbacks either completely or partially. Hence, we aim to adopt a system that can using necessary tools and services remove the above stated disadvantages to the maximum possible extent.

1.2 Proposed Solution

With an aim to eliminate the drawbacks stated in the previous section and make the system of generating necessary insights better, we can develop a system that can handle visualizations. The main reason behind supporting the visualizations is that these visualizations of facts and figures is capable to assisting any individual in gaining necessary insights on any type of data in a faster and a more accurate way. A dashboard, having all the data visualizations, properly arranged and designed will help in gaining necessary information at a single glance. This would help in incrementing the pace of having insights into the data.

A system having the following features is proposed as a solution for the above challenges:

a) Make use of visualizations (graphical representations) to represent the facts and data of the existing data.
b) Certain types of visualizations (like the line graph) maybe used to forecast the data.
c) All the important visualizations might be arranged in a useful manner in the form of a dashboard. This dashboard should be designed in such a way that it should be able to generate necessary insights at a single glance.
d) Have a system to normalize (prepare) the raw data
e) The normalized data can then be used for visualization tasks

So, we identify a platform having all these features at a single place. It was found that there exist several platforms that meet the above stated criteria. We here use the IBM Cognos Analytics tool to gain necessary insights into the data collected. The tool was also capable of forecasting things, making it a suitable platform to have a projection of possible sales into the future.

CHAPTER 3

THEORITICAL ANALYSIS

1.1 Block Diagram

Having understood the tool that we would be using for gaining the necessary insights from the data, it is now pertinent to understand the dataset that we have got for analysis. As observed, the dataset procured has 4 columns. The 4 columns are namely, the date, the sales, the price and the stocks column.

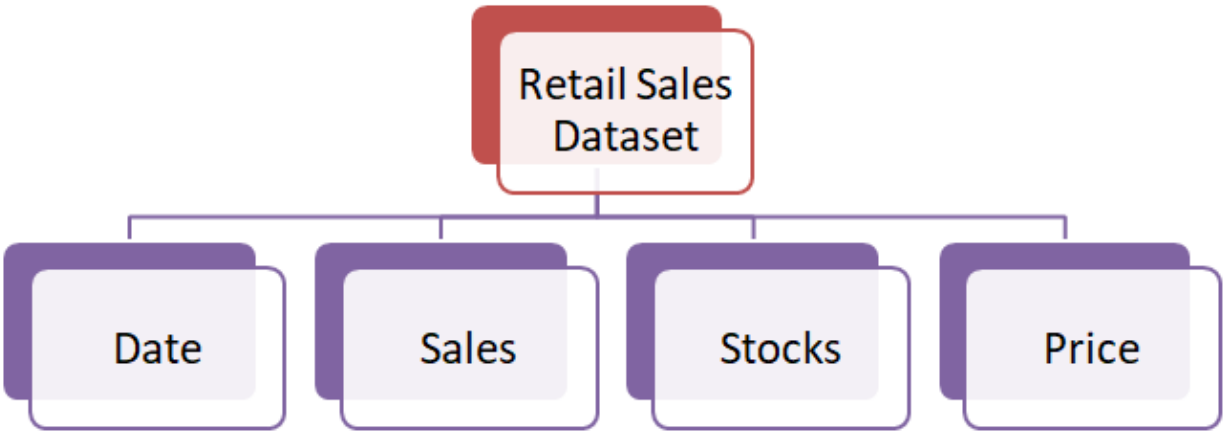


Figure 1: Dataset Arrangement

The columns present in the dataset (Retails Dataset) are interpreted as follows:

a. **Data Column** – corresponds to the data
b. **Sales Column** – corresponds to the sales data (venda)
c. **Stocks Column** – corresponds to the stocks in the inventory (estoque)
d. **Price Column** – corresponds to the price (preco)

1.2 Hardware/Software Requirements

Execution of the externship project has the following system requirements:

a. **Hardware Requirements** – Computer with a 4GB RAM, 1TB ROM, Windows OS, Quad Core Processor
b. **Software Requirements** – Windows OS, Support to Internet facility, access to MS Office

CHAPTER 4

EXPERIMENTAL INVESTIGATION

1.1 IBM Cognos Platform Analysis

The IBM Cognos is a Data Analytics platform developed by IBM. This platform acts as a useful tool for performing the data analytics operations. An (student) account needs to be created in the IBM Academic Website before gaining an access to the IBM Cognos. After successfully creating an account, the user (student) is expected to register for the IBM Cognos Platform. The user after successfully registering for the platform is eligible for accessing the platform features on a trial basis.

The IBM Cognos website is observed to have the following sections:

1. Uploading the Dataset
2. Preparing the Data
3. Exploring the Data
4. Visualizing the Data

The dataset procured (downloaded) is first uploaded into the IBM Cognos Platform. The dataset uploaded is then prepared for carrying out proper visualization. The prepared dataset is then fed into the dashboard module to carry out visualization. The dashboard has all the visualizations carried out on the input data.

1.2 Calculation

Certain kinds of preprocessing can be done on the dataset for better analysis. In this dataset we observe that we have a date column. We now convert this date into Month wise column and also create one new column for revenue.

The data column is converted into the month column using the following formula:

M_date = Month(data_)

The month wise column will now help us get the information month wise, rather than date wise. This would enable us having a better summarizing of facts month wise.

The Revenue column is created using the following formula:

Revenue = price * sales

The Revenue column would indicate the Revenue generated from the sales. The data would help us gain better insights on the Sales of the organization.

CHAPTER 5

METHODOLGY

The Externship Project essentially revolves around analyzing and generating forecasts of important information related to sales of the organization. The information analyzed and generated is presented at one place thereby enabling the higher authorities to get the crisp of the knowledge at a single glance. This is executed by carrying out the following steps:

1. Download (Procurement) the Retail Sales Dataset from Kaggle Website.
2. Register yourself with the IBM Academic Website.
3. After successful registration, Login to the IBM Academic Website.
4. Register yourself with the IBM Cloud and IBM Cognos Analytics.
5. After successful registration, launch the IBM Cognos Analytics tool.
6. Upon opening the tool, we see that there are 4 sections that corresponds to:
    a. Uploading the Data
    b. Preparing the Data
    c. Exploring the Data
    d. Visualizing the Data
7. The Downloaded Data is then uploaded using the 'Upload the Data' section on the IBM Cognos Analytics.
8. After successfully uploading the data, the data is then prepared by clicking on the next column.
9. Here, we perform necessary data preparation operations (like filtering, changing the data type of the column, changing the name of the column, etc.)
10. We also perform the calculations given in the earlier section under the calculation field. This step leads to the generation of M_data column and Revenue column.

11. After the data is prepared, we next perform visualizations for all the aspects that could generate useful information, to obtain insights on the sales data of the company. The Visualizations are done for the following aspects of the dataset.

    a. **Year wise Price using Line Graph**
        - A line graph is constructed between the Year and Price factors. The year being the independent factor is taken on the X axis while the Price being the dependent factor is taken on the Y axis.
        - The properties of the constructed graph are then tweaked by performing some operations on it. This tweaking led to better representation of the data.
        - The past data was also interpolated (forecasting) to enable the higher authorities have a better grasp on the possible future trends.

    b. **Year wise Stock using Line Graph**
        - A line graph is constructed between the Year and Stock factors. The year being the independent factor is taken on the X axis while the Stock being the dependent factor is taken on the Y axis.
        - The properties of the constructed graph are then tweaked by performing some operations on it. This tweaking led to better representation of the data.
        - The past data was also interpolated (forecasting) to enable the higher authorities have a better grasp on the possible future trends.

    c. **Top 10 Sales by Year using Line Graph**
        - A line graph is constructed between the Year and Sales factors. The year being the independent factor is taken on the X axis while the Sale being the dependent factor is taken on the Y axis.
        - The obtained line graph is then subjected to filtering operations. The graph is modified to display only the top 10 sales (along with the values) that happened in the past.

- The properties of the constructed graph are then tweaked further by performing some more operations on it. This tweaking led to better representation of the data.
- The past data was also interpolated (forecasting) to enable the higher authorities have a better grasp on the possible future trends.

d. Top 10 Revenue by Year using Line Graph

- A line graph is constructed between the Year and Revenue factors. The year being the independent factor is taken on the X axis while the Revenue being the dependent factor is taken on the Y axis.
- The obtained line graph is then subjected to filtering operations. The graph is modified to display only the top 10 revenues (along with the values) generated in the past.
- The properties of the constructed graph are then tweaked further by performing some more operations on it. This tweaking led to better representation of the data.
- The past data was also interpolated (forecasting) to enable the higher authorities have a better grasp on the possible future trends.

e. Monthly Stock using Heat Map

- Heat Map visualization is constructed for Monthly Stocks using the IBM Cognos Analytics tool.
- The properties of the developed visualization are then tweaked further by performing some operations on it. This tweaking led to better representation of the data.

f. Monthly Sales using Tree Map

- Tree Map visualization is constructed for Monthly Sales using the IBM Cognos Analytics tool.

- The properties of the developed visualization are then tweaked further by performing some operations on it. This tweaking led to better representation of the data.

g. Monthly Revenue using Pie Chart

- A Pie Chart was developed for the Monthly Revenue data using the IBM Cognos Analytics tool.
- The properties of the developed visualization are then tweaked further by performing some operations on it. This tweaking led to better representation of the data.

h. Summary Cards of Total Revenue, Sales, Stock, Price

- Summary Cards was developed for Total Revenue, Sales, Stock and Price data using the IBM Cognos Analytics tool.
- These Cards display the exact values in the form of cards. Modifications to the way of representing certain values were made in order to make it a better way of presenting the data.

12. After generating visualizations for all the relevant aspects of the organization, a dashboard is created. The Dashboard is designed in such a way that it could give all the information in just one glance.
13. The generated Dashboard is then saved for future reference.
14. We finally logout from the IBM account.

CHAPTER 6

FLOW CHART

The steps taken during the execution of the Externship Project are represented as a flow chart. The flow chart (in an abstract manner) is as shown below:

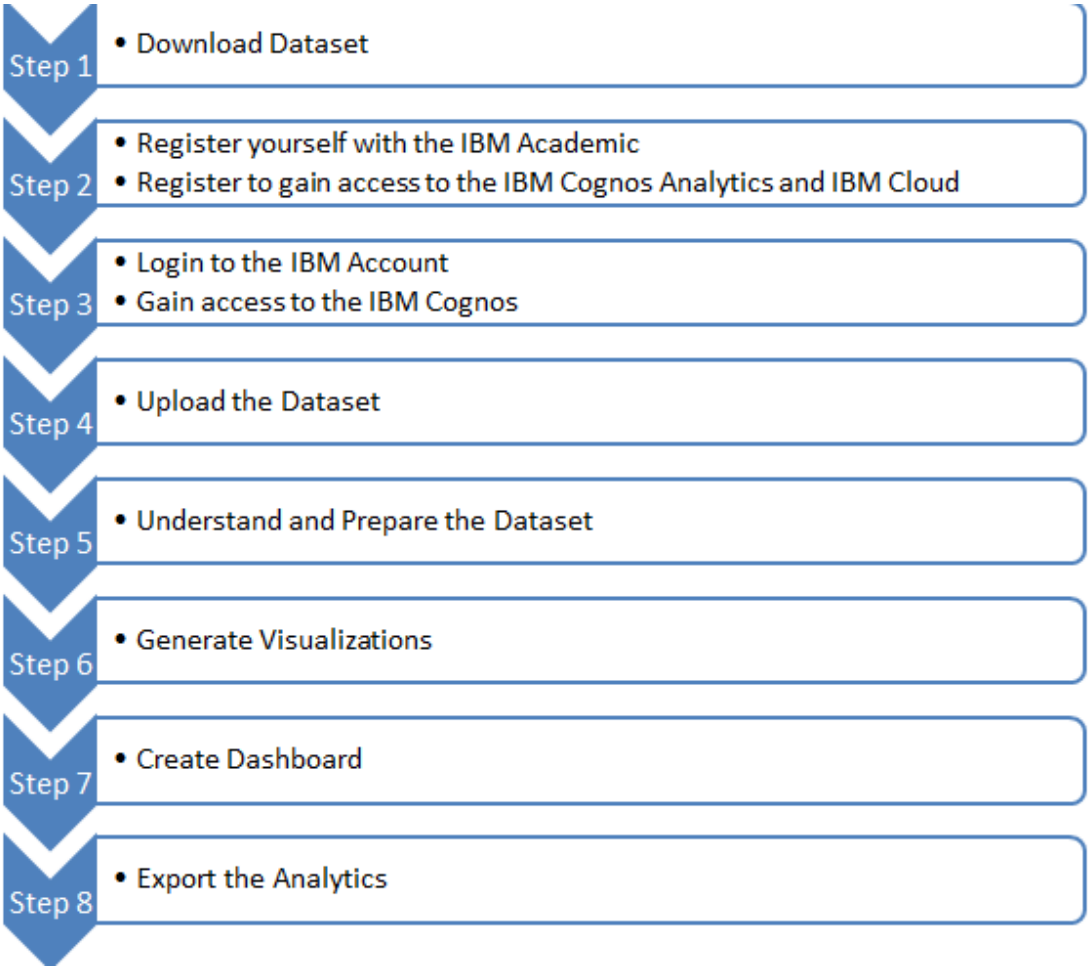


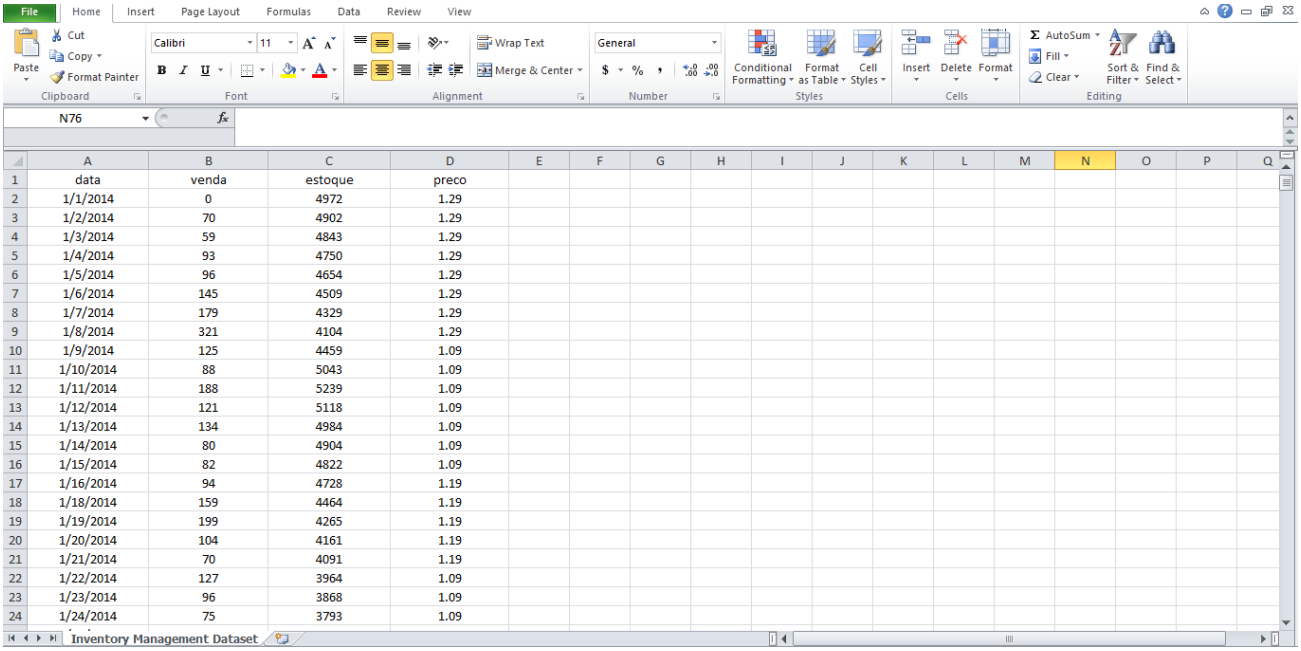
Figure 2: Flowchart

CHAPTER 7

RESULTS

The results obtained at different phases during the internship are as shown below:

1. DATASET



	A	B	C	D
1	data	venda	estoque	preco
2	1/1/2014	0	4972	1.29
3	1/2/2014	70	4902	1.29
4	1/3/2014	59	4843	1.29
5	1/4/2014	93	4750	1.29
6	1/5/2014	96	4654	1.29
7	1/6/2014	145	4509	1.29
8	1/7/2014	179	4329	1.29
9	1/8/2014	321	4104	1.29
10	1/9/2014	125	4459	1.09
11	1/10/2014	88	5043	1.09
12	1/11/2014	188	5239	1.09
13	1/12/2014	121	5118	1.09
14	1/13/2014	134	4984	1.09
15	1/14/2014	80	4904	1.09
16	1/15/2014	82	4822	1.09
17	1/16/2014	94	4728	1.19
18	1/18/2014	159	4464	1.19
19	1/19/2014	199	4265	1.19
20	1/20/2014	104	4161	1.19
21	1/21/2014	70	4091	1.19
22	1/22/2014	127	3964	1.09
23	1/23/2014	96	3868	1.09
24	1/24/2014	75	3793	1.09

Figure 3: Dataset

This screenshot corresponds to the dataset.

2. UPLOADING DATASET

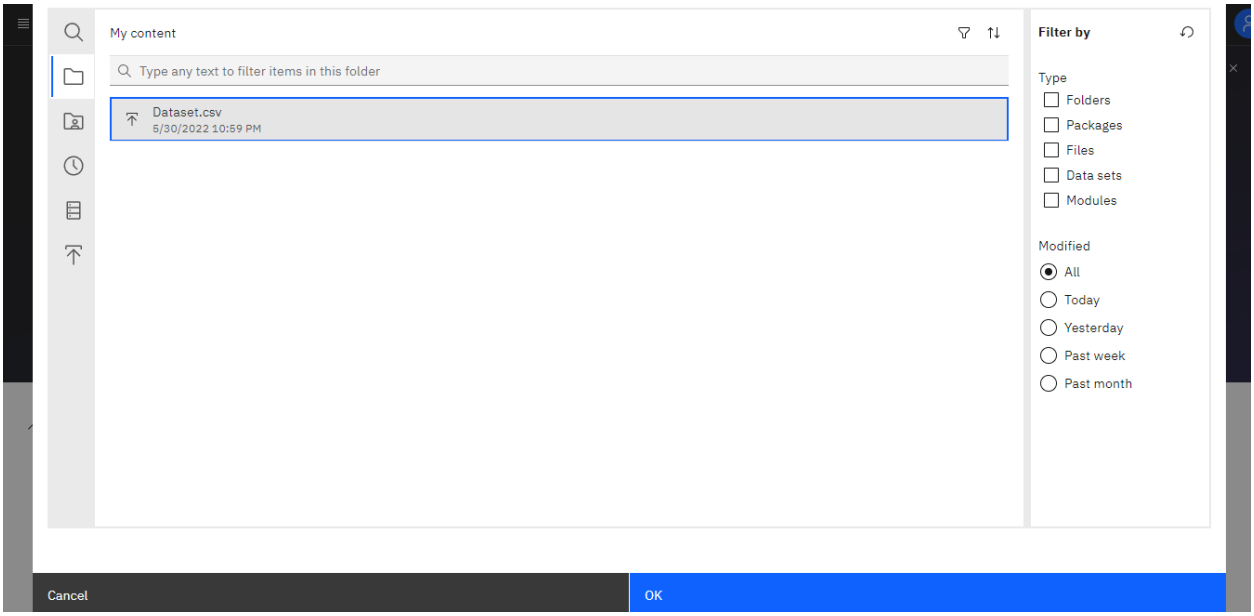


Figure 4: Uploading the Dataset

This screenshot corresponds to the phase of uploading the dataset.

3. PREPARATION OF DATASET

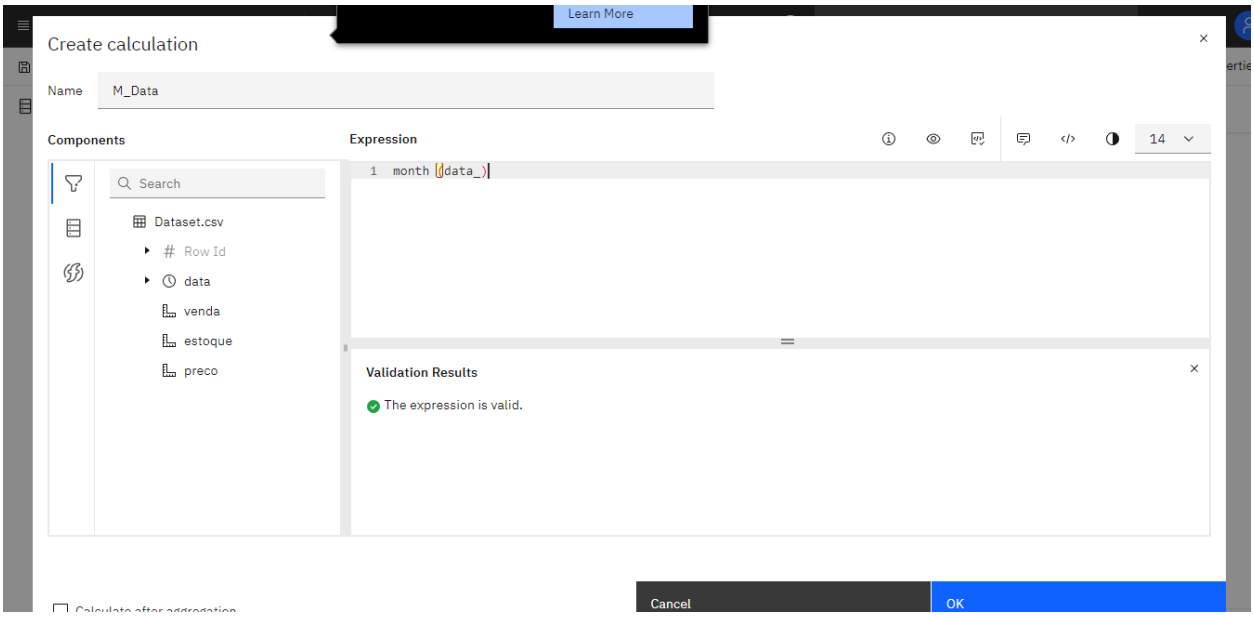


Figure 4: Preparation of Dataset (One of the steps)

This screenshot corresponds to the phase where we prepare the dataset for visualization. During the dataset preparation phase, we carry out multiple operations on the dataset. These operations are carried out to enable us to have a better dataset for proper visualization of figures.

4. VISUALIZATION

The upcoming screenshots relates to the various visualizations constructed from the different aspect combinations.

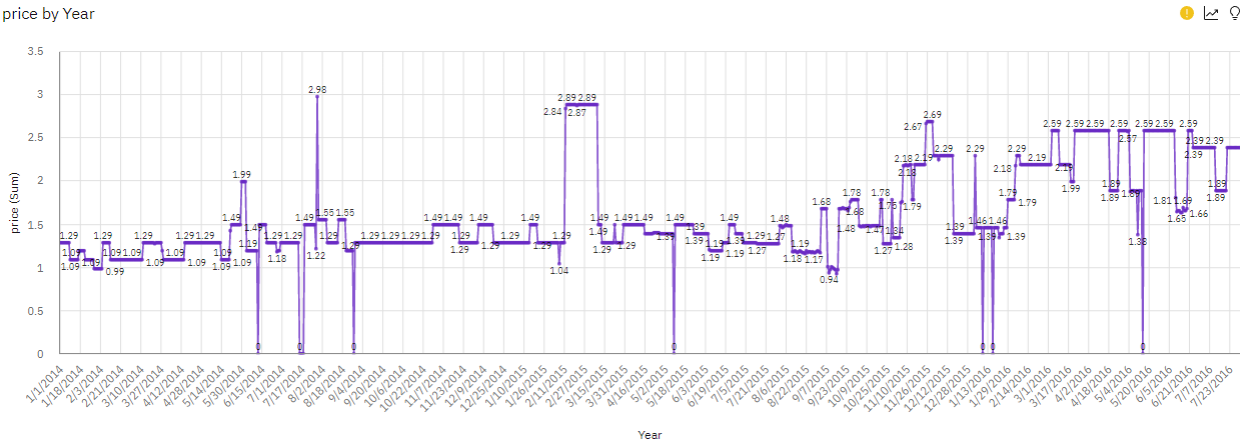


Figure 5: Year wise Price using Line Graph

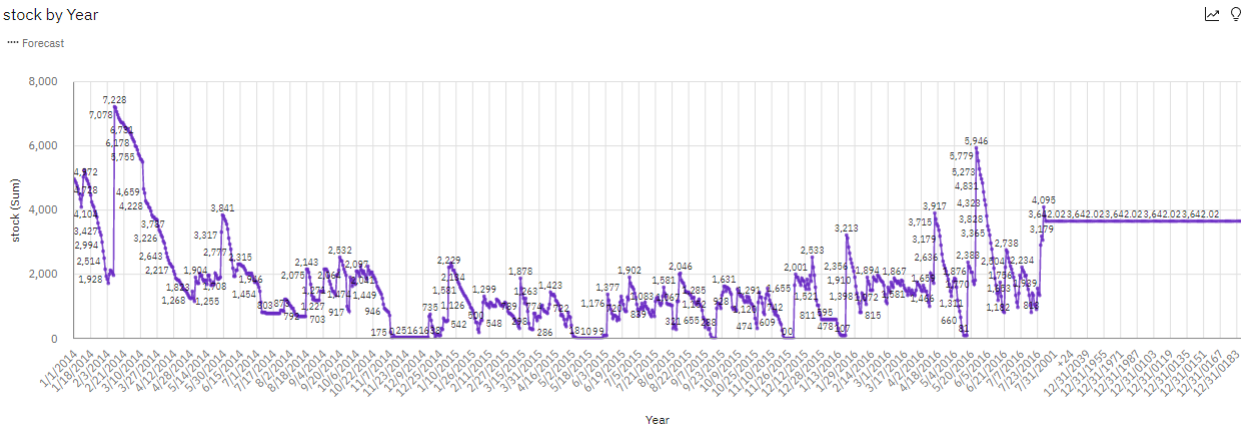


Figure 6: Year wise Stock using Line Graph

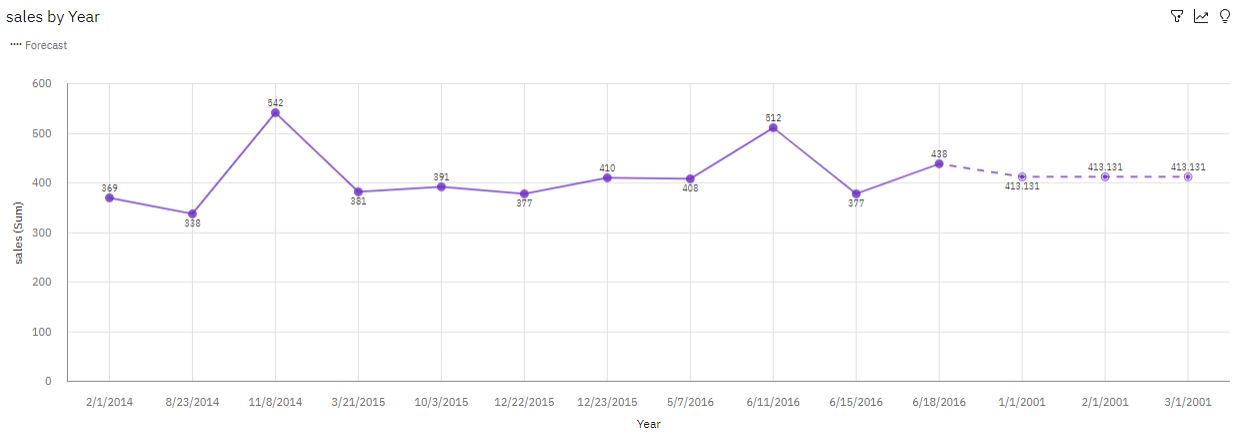


Figure 7: Top 10 Sales by Year using Line Graph

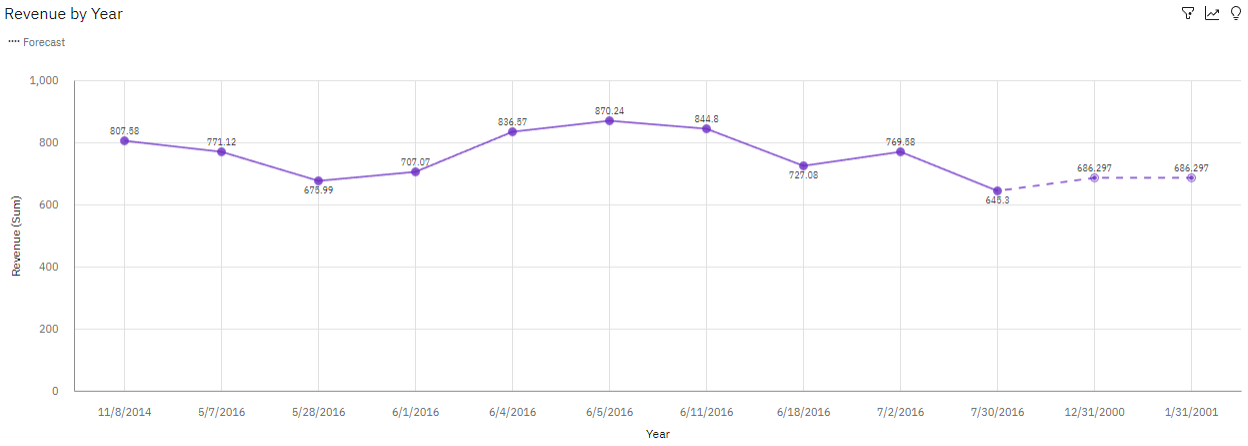


Figure 8: Top 10 Revenue by Year using Line Graph

Figure 9: Monthly Stock using Heat Map

Figure 10: Monthly Sales using Tree Map

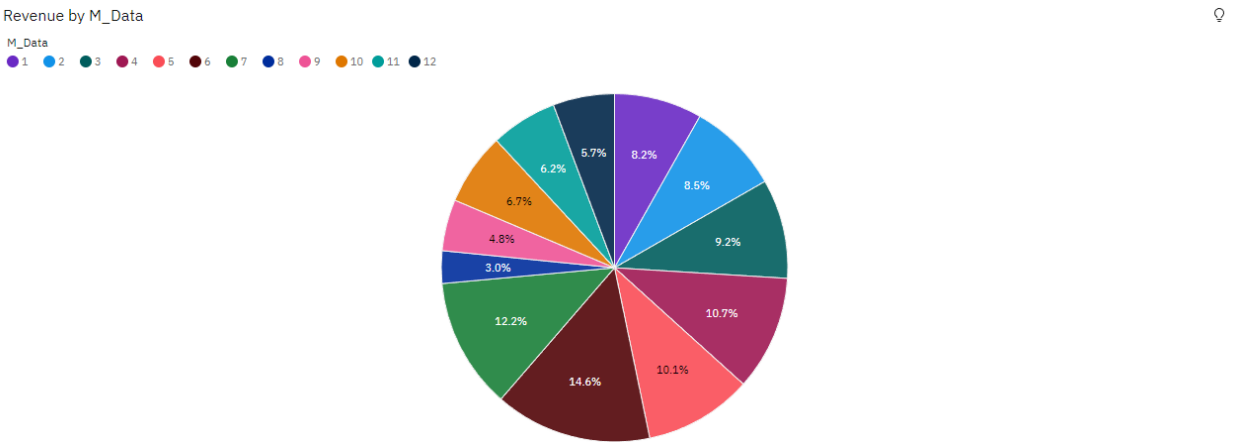


Figure 11: Monthly Revenue using Pie Chart

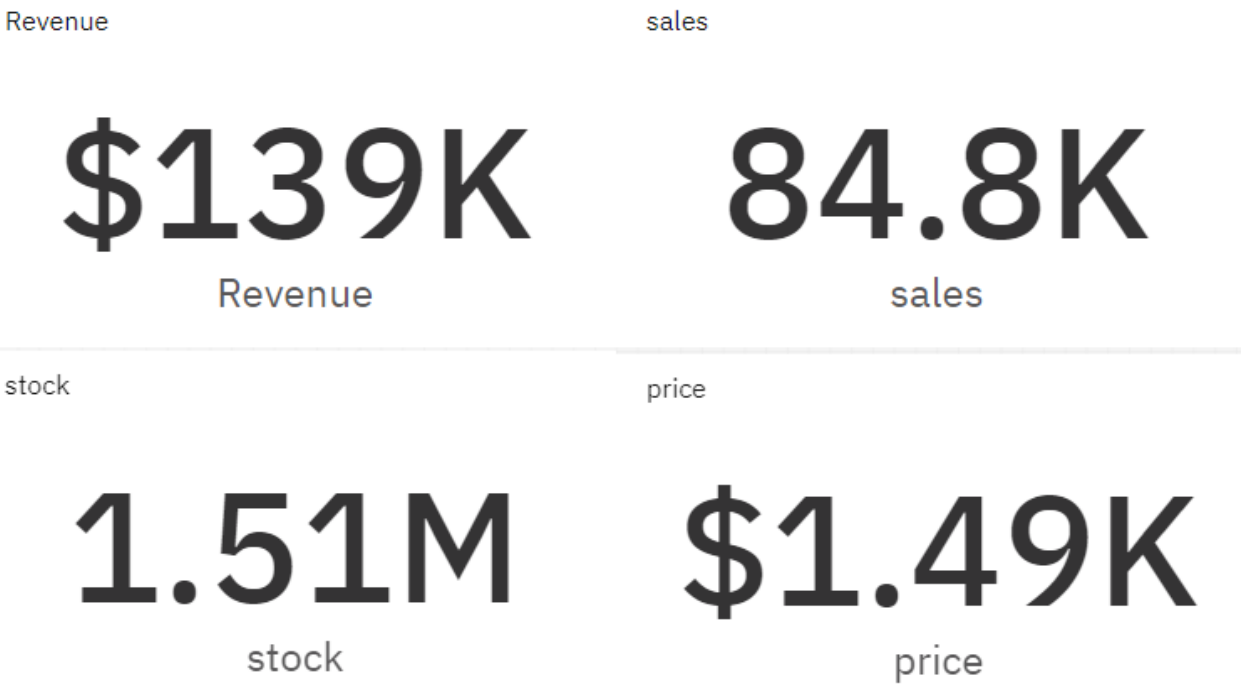


Figure 12: Summary Cards of Total Revenue, Sales, Stock, Price

5. DASHBOARD CREATION

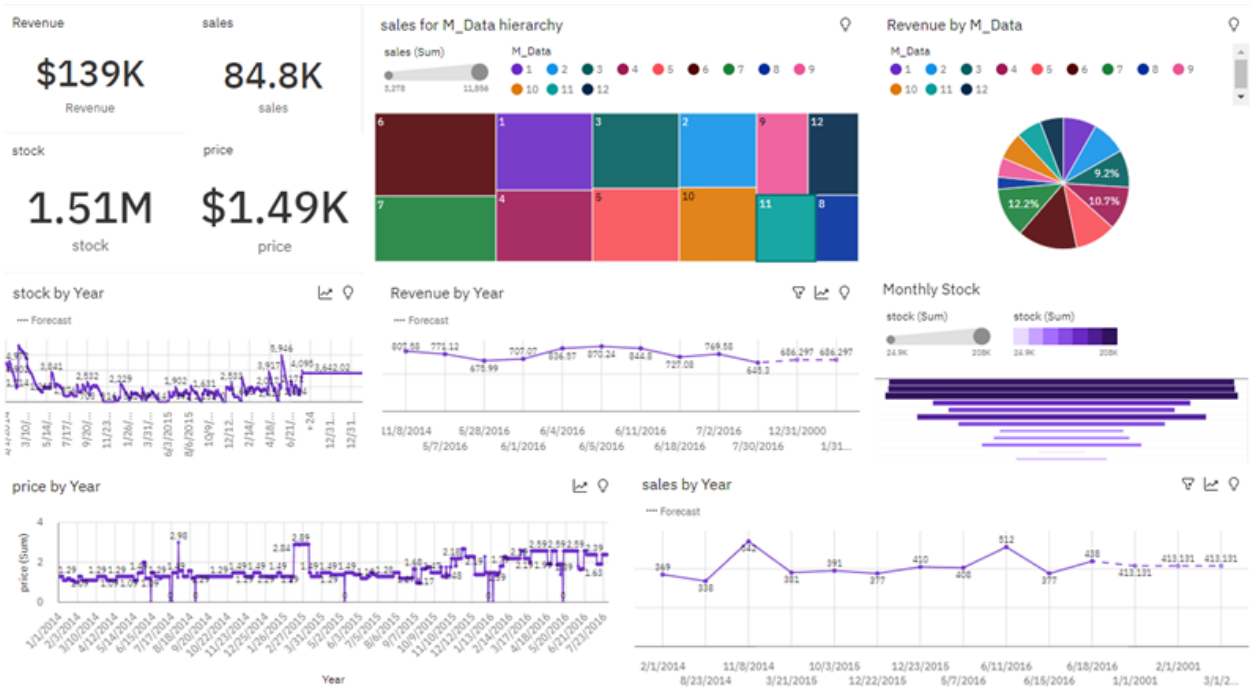


Figure 13: Dashboard

We finally combine all the visualizations into a single dashboard for better viewing. The dashboard is arranged in such a way, that it can provide all the necessary information in a single glance.

CHAPTER 8

ADVANTAGES AND DISADVANTAGES

1. Disadvantages of the existing non Dashboard type System:

The following are the disadvantages of not having a Dashboard type system:

a) The data usually present in CSV forms are hard to interpret and draw any necessary conclusions.
b) The data present in these databases are present in huge amounts, so getting useful insights become very hard.
c) Visualizing the trends/patterns present in such data becomes nearly impossible.
d) Forecasting based on past trends becomes a very hard task to achieve.
e) Time Intensive Process
f) Requires huge investment of efforts into the process.
g) Difficult to identify the possible errors and outlier values.
h) Even after investing huge efforts, it might not always lead to correct interpretations. Incorrect interpretations might lead to greater damage to the company.

2. Advantages of Dashboard type System:

Most of the disadvantages in the traditional system are eliminated by employing a Dashboard based System. The following are some of the advantages of a Dashboard type system:

a) Ease in understanding data
b) Total Visibility into Your Business
c) Increased Profits
d) Reduced Stress

e) Help have faster insights into the data
f) Big Time Savings
g) Increased Productivity
h) Improved Results

CHAPTER 9

APPLICATIONS

The Externship Project essentially revolves around performing Data Analytics using IBM Cognos as a tool. Data Analytics is an emerging domain in the current decade of Industry 4.0. There are several places where we can apply the concepts of Data Analytics. Some of the domains include:

a. Healthcare
b. Logistics of an organization
c. Manufacturing of Products
d. Military
e. Travel
f. Fraud Detection
g. Transportation
h. Insurance
i. Entertainment
j. Digital Marketing

Visualization carried out during the process of analyzing data is usually represented in the form of Dashboards for easy and quick understanding. IBM Cognos Analytics acts as one of the most prominent tools used in the present day industry. This tool can be used to assist the process of Data Analytics in any organization to support its growth in the market.

CHAPTER 10

CONCLUSION

During this externship project, we were exposed to various phases of the Data Analytics using the IBM Cognos Analytics as a tool. We were asked to perform data analytics on the retail sales forecasting dataset, procured from Kaggle. During the process, we learnt how to import data, how to prepare data and also the various techniques of visualizing the data. We also learnt the technique of creating a Dashboard, the end product of the project.

In this Externship Project we could learn the working of the IBM Cognos Analytics tools. We could learn how we could prepare/pre-process the imported data. We also learnt the various types of visualization techniques. We could finally learn the technique develop a Dashboard using IBM Cognos Analytics tools. We also learned the importance of developing a Dashboard in the Real World.

CHAPTER 11

FUTURE SCOPE

With the increase in the market competition, data analytics have emerged to be one of the most promising techniques for analyzing their growth in the past and strategizing accordingly to enable a faster growth in the future. This has led to the development of a huge scope in this sector.

For the given dataset, the analysis of several others aspects in the data might provide us more valuable insights into the data. This valuable information might be used to support the growth of the organization. Since, within an organization generation of data is always going to remain, analyzing them for their faster growth will always remain an integral part of the process. Hence, Data analytics has become an emerging domain in every organization competing in the market for their growth.