

REAL-TIME DATA VISUALIZATION USING BUSINESS INTELLIGENCE TECHNIQUES AND MAKE A FASTER DECISION ON SALES DATA

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ABSTRACT

Day by day business has gone be more complicated and more competitive. Sales are the most valuable part of a business. Only the sales report of a business is not enough for today's business development. The activity needs to get an insight into sales using data because of data-driven decision is more impactful. The purpose of the research is to develop an affordable and approachable model to deliver a business insight that helps you to understand your business and support to make business decisions faster. In this piece of research work, a model is proposed to develop an affordable simple sales data insight helping with Business Intelligence technique and cloud database. In terms of modern technology to control a vast amount of data for business decision-making process need to be more efficient. However to use a traditional database system business shrink to meet their real user's data. Against this backdrop, this model through the research of Business Intelligence Model of how to collect sales data fast and analysis with Power BI. Moreover, this model, elaborate on using Business Intelligence. This model uses a set of data, with ad Hoc query, Statistical analysis, some Mathematical Equation, and Data Visualization is a key component to gain a proactive and data-driven solution.

TABLE OF CONTENTS

Contents	Page No.
Board of Examiners	16 Error! Bookmark not defined.
DECLARATION	Error! Bookmark not defined.
ACKNOWLEDGEMENT	Error! Bookmark not defined.
ABSTRACT	i
TABLE OF CONTENTS	ii
LIST OF FIGURES	iii
Chapter 1	1 <small>20</small>
INTRODUCTION	1
1.1 Introduction	1
1.2 Motivation	1
1.3 Rationale of the Study	2
1.4 Expected Output	2
1.5 Report Layout	2
Chapter 2	4
BACKGROUND	Error! Bookmark not defined.
2.1 Introduction	4
2.2 Literature Review	4
2.3 Related Works	7
2.4 Research Summary	8
2.5 Scope of the Problem	9
2.6 Challenges	9
Chapter 3	10
RESEARCH METHODOLOGY	10
3.1 Introduction	10
3.2 Research Subject and Instrumentation	11
3.3 Data Collection Procedure	13
3.4 Equations:	15 <small>1</small>
3.5 Implementation Requirements	16
Chapter 4	17

EXPERIMENTAL RESULTS AND DISCUSSION	17
4.1 Introduction	17
4.2 Experimental Results	17
4.3 Descriptive Analysis	21
4.4 Summary	23
1 Chapter 5	24
SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH	24
5.1 Summary of the Study	24
42 5.2 Conclusions	24
5.3 Implication for Further Study	25
REFERENCES	26
APPENDICES	28
Appendix A: Research Reflection	28
Appendix B: Related Issues	28

LIST OF FIGURES

21	
Figure 1 : Magic Quadrant of BI Platform	5
Figure 2 : Working Procedure for the Proposed Model	10
Figure 3 : Trello for Project Management	12
Figure 4 : Category Data Table	14
Figure 5 : Sales Data Table	14
Figure 6 Data Table Relation	15
Figure 7 : KPI Card	17
Figure 8 : Clustered Colum chart	18
Figure 9 : Line and Stacked Colum chart	18
Figure 10 : Map View	19
Figure 11 : Clustered Bar chart	19
Figure 12 : Pie Chart of Sales Data	20
Figure 13 : Scatter Plot	22
Figure 14 : Power BI Dashboard	23

Chapter 1

INTRODUCTION

1.1 Introduction

Data Analyzing to visualize is a process of improving the performance of business systems and achievement its goal also compete with others. Although a huge issue to collect sequentially changes in data while rapidly changes customer needs. Moreover Balancing the Data collect demand with maintaining the storage using Data warehouse which is quite challenging. Therefore, we support the access for data collected instantly and more frequently with fastest ad hoc queries to be answered. Likewise, our model makes it happen to Analyze to visualization in quite a simple way. It's a process of Input data collected from the user into an application transforming information into a visual form enabling the viewer to observe the downward trend and hike uptrend. However this model help to deliver on time and give the best output with various mediums such as Web View, Mobile or Desktop.

Regarding this Model, it can give result in any circumstances investments occur. The user can experience an outstanding competences Business intelligence system which makes easier than others.

1.2 Motivation

In terms of modern technology business decisions, getting's change rapidly using business intelligence. In contrast, so many established businesses just made decisions from their own philosophy or opinion. For that, they have got the output as a fall in business work. On the other hand, Business intelligence makes decisions through machine analysis. However, it has minimum chances of losing data with get a logical visualization which makes an efficient decision. Sales analysis report can show a company's actual sales situation within a specific time quarter, monthly yearly or any customized period. But if the business owner or business analytics can't figure out what's going on sales they can't take the about sales and other business-related issues. [1]

In Bangladesh, most of the business owners and business decision-maker don't think that sales data insight is most valuable for their business. Some of them believe that is important but can't manage it and don't know how to use it. Nowadays sales data is the most important thing. Because sales are the final revenue for a company. Depend on sales data we can predict customer behavior like as market trend, future demand of the product. [2]

1.3 Rationale of the Study

Regarding this project, Information analysis capabilities for an intelligent solution with visualization. However, we can very quickly connect to a wide range of data sources with very little effort and use this data to run Heathrow more smoothly than ever before. In addition, we were able to see where we were significantly behind the regional trend, focus on the problem, and create a solution. Although, it facing users in local user groups to grow their skills, collaborate, and learn from each other.

1.4 Expected Output

Considering this Business Intelligence model and Data Warehouse design Make available in a dashboard where there is the possibility of the user imputing information and this information will interact with a measure and that finally this measurement will be displayed in graphical, for example, the goal is to minimize repetition of data across the tables.

1.5 Report Layout

Chapter 1: Introduction

In this chapter we have discussed the introduction, motivation of the work, Rationale of the Study and expected outcome of the research and the report layout.

Chapter 2: Background

In this chapter, we have discussed the background of our research. We also provide the literature review of our research some relates work information background research summary and scope of the problem. Also the challenges of this research.

Chapter 3: Research Methodology

In this chapter, we have discussed our proposed model. What's are in our Model, Our Research subject and what was we used in our research. We also discussed sample data, Data collection story, some equations discussion and Requirements of Implementation.

29

Chapter 4: Experimental Results and Discussion

In this chapter, we have discussed our experimental results and discussion about our results.

1

Chapter 5: Summary, Conclusion, Recommendation and Implication for Future Research

In this chapter, we have discussed Summary of our whole research and some recommendations. We also include what needs for future research.
33

Chapter 2

LITERATURE REVIEW

2.1 Introduction

According to our proposed model is a combination of cutting edge modern technology's that easily useable and maintainable. Which is a result of various previous research. We are very much interested to implement the previous reference to our proposed model for that reason we study literature as much as possible. We believe that there is no scope to develop new innovation without study.

2.2 Literature Review

The Author of [3] [4] paper say that today's business suffering some information overload situation and business analysis sources show that:

- 61% manager thinks that they have enough information at their workplace.
- 80% think and believe the will get worse.
- Over 50% of managerial staff ignore data for current decision-making because they think information overload and information Garbage.
- 84% of managers store their information for future use, they don't use that for the current analysis.
- 60% believe that the information gathering and analysis cost is outweighed its value.
- Data Volume is increasing the speed of 44X in the next decade it will reach 800K petabytes to 35 zettabytes [4]
- 77% of Executives companies can't have real-time information so they can't take decision rapidly.

Previously business data or sales data were analyzed by statistical techniques, but nowadays it's outdated. Only statistical techniques are not enough for real-time business

decision and data analysis. We need to mine the data related to our business. Business intelligence techniques help us to do that.

Business Intelligence:

41

Business Intelligence is a way of gaining advantage from business using data. This data can be User information, Stock information sales report or any source that related to its business. From a large amount of data, business intelligence mining the information and convert them to knowledge which plays a role for a decision support system. BI is a most effective way to make a data-driven decision. BI Visualize data and give us a visual look of data that can be easily understood. [5]



Figure 1 : Magic Quadrant of BI Platform

Gartner Magic Quadrant:

Gartner BI Magic Quadrant for Analytics and Business Intelligence Platforms Power BI is the leading Platforms for Business Intelligence related work. Gartner is a leading research and advisory company that provides every year a research report about various technology and platform. In 2019 BI Magic Quadrant Power BI is a Top Raking Platform for Business Intelligence. 39

Mobile Business intelligence:

Mobile Business Intelligence provides access to BI-related information on a smartphone and Tablets. It provides data such as KPIs, business metrics, and dashboards on mobile devices. The Initial idea about mobile business intelligence is back to the 1990s when the mobile phone is increasing performance and popularity.

3V in Data:

3v data means volume, variety, and velocity. Every big or small business is to manage a considerable amount of data generated by its various data points and business process. when data cannot fit into such tools: excel sheets, access, database and human error instances above accepts limits due to intensive manual processing, it is time to think about big data and analytics.

VOLUME: Volume refers to the amount of data generating through websites. Like Facebook has 2 billion users, YouTube has 1 billion users, Twitter has 350 million users and each and every day there users upload billions of images, posts, tweets, videos, etc.

VELOCITY: Velocity refers to the amount of time or speed with which data are generated. The generate of a big amount of data every day from some big company Facebook, twitter, YouTube and 3.5 billion searches from Google. This is like a nuclear data explosion. Big Data helps the company to hold this explosion, control flow of data and at the same time process it fast so that it does not create bottlenecks.

VARIETY: Variety refers to the amount of all the structured and unstructured data that has the possibility of getting generated either by humans or by machines. Manage structured data - texts, pictures, posts, videos. However, unstructured data are emails, hand-written text, audio recordings etc., are also important elements under Variety. Variety have the ability of classify category of data.

Business Intelligence vs. Big Data:

Area	Business Intelligence	Big Data
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Purpose	The purpose of Business intelligence is to help the business to predict and make better decisions. Business Intelligence helps extracting information directly from the data source.	The purpose of Big data is capture, processing and analyze the data, both structured and unstructured to improve and ensure customer need & outcomes. Normally preparing huge amounts of data on an ongoing basis. Most of case deal with lots of data.
Ecosystem/ Components	Operating system, ERP Database, Data Warehouse, Dashboard etc.	Hadoop, Spark, R, Server, hive, Hdfs etc.
Tools	Tableau Sisense Data Warehousing Digital Dashboards and Data mining Microsoft Power BI	Hadoop Spark Hive Presto Cassandra Cloudera
Benefits	<ul style="list-style-type: none"> • Helps in making better business decisions • Improved data quality • Reduced costs • Increase revenues • Improved operational efficiency etc. 	<ul style="list-style-type: none"> • Fraud detection • Storage, mining, and analysis of data • Market prediction & forecasting • Improves the service • Keep up with customer trends • Cost savings

2.3 Related Works

In previous, there are lots of works has been done with Business Intelligence but very few are work on real-time Data Visualization on Business Data.

"An Economic and Modern Business Intelligence Solution for Textile Industries in Bangladesh" [2]

In this research, researchers have proposed a model of business intelligence which collected data by various forms like Email, Compact Disk, and scan copy of the hardcover report, etc. Then all data are stored into the master database from master database Business Intelligence tool Tableau use to analyze those data and it gives a result of sales data.

25

"An ontology-based business intelligence application in a Financial Knowledge Management system" [1]

In this research, researchers have proposed a system or model with detail of model and work procedure. From Data Source to processing section data will be processed with metadata Taxonomy Module then going to ETL Module then it's storage to Data Warehouse after that processed data will be provided. They also use an FKMS (Financial Knowledge Management System) Application for that Research.

8

"Real Time Business Intelligence for the Adaptive Enterprise" [6]

In this research, researchers have proposed a system or model called RTBI which is real time proposed soulution that collect data and store in Operational Database Use ETL processed the data save to Data Warehouse then using some Analytical Application and Prossing that data publised in the web page troug the internet.all processing are complete in real time so they called that RTBI (Real Time Business Intelligence).

2.4 Research Summary

Lots of researchers are trying to develop a modern and efficient system that actually helps business executives and business analytics to know more about their business. Because of lots of business get fail for just only don't get to know about their business data.

And many business executives have many data but can't process them.

2.5 Scope of the Problem

The Proposed Model is a totally technical and IT Enable system. If Any Body can try to understand they can't easily understand the whole process at a glance. But as an IT or Technical people, everyone can easily understand our Proposed Model. So there is some Problem available. The Power BI is not just a Data Visualization tool but also a powerful Data manipulation tool so it's also quite tuff to understand easily. So considering those this model is Modern and Affordable.

2.6 Challenges

This Proposed model have some Module or Component that face some Challenges like, Mobile Application Interface It's Need to be user friendly, Real-Time Data Processing Application API Etc.

- End-User Mobile Application.
- Internet Depend Data Communication.
- API For Firebase Database.
- Data Warehouse for Local Data.
- Knowledge about Data Visualization.

RESEARCH METHODOLOGY

3.1 Introduction

The diagram demonstrates the process of data collected for visualization. While the process is complete with seven different segments wherein the initial stage data is collected from the input field (internal or external users) and store in a local database as offline. [7] However when it is connected with the internet then the data store in a major database which is called Firebase cloud storage. Which are count as raw data on the next stage, raw data are going to short and merge for input in the most important part of Data processing. Therefore raw data are processed by business analytics [8] service where interactive visualizations and business intelligence capabilities with an interface simple enough for end-users to create an intelligent report and illustrates a dashboard respectively. Finally, in the last process as visualization, it gives output through Electronic devices such as Mobile, Desktop, and Web View.

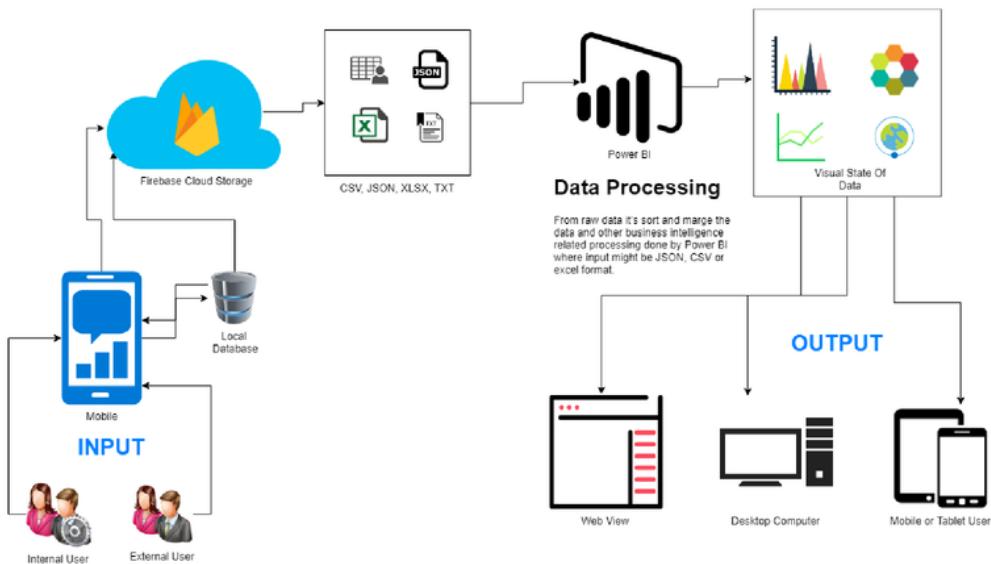


Figure 2 : Working Procedure for the Proposed Model

1

3.2 Research Subject and Instrumentation

Research Subject:

Research subject: we have proposed a model that develops an easy data collection system with no big or massive data warehouse and simple file type data collected through a mobile application or any web form Basically we are working on with sales data which is a common data of business with sales data. We analysis of the sales data.

Instrumentation:

Design:

40

Draw.io: This is an open-source online tool for designing diagram, such that flow charts, process diagrams, org charts, UML diagrams, ER models, network diagrams, and much more.

24

Report Writing:

Google Docs: This is an online-based document application. That is used in online at any computer with internet. And access user can view, edit

Microsoft word: Microsoft word is a mostly used word processing application for creating any types of documents like letters, quizzes, and student assignment

Notepad: This is the very simple text-editor application for windows operating system. That is used for writing a short document that you want to store in plain text.

Data Analysis:

31

Microsoft Power BI: Microsoft power bi is a business intelligence tools that are used for data analytics, data visualization for small of big business and shares insight across your business. The free version of power bi is designed for small and medium business owners and professional version is called power bi plus which not free.it available for a monthly subscription fee. [8]

18

Project Management:

Trello: Trello is online tools for project management actually, Trello contains the list of lists, filled with the card used by you and your team members.

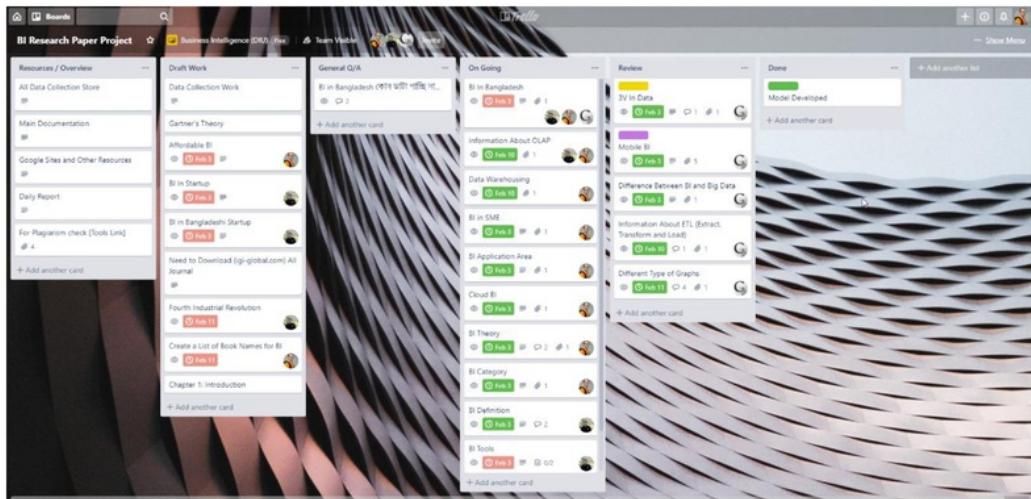


Figure 3 : Trello for Project Management

Communication:

Hangout: Google hangout is the online calling platform that helps us communicate with each other for group discuss

Email: we use email for communication with our supervisor and all team members

Data Store and Share:

Google Drive: Google drive is the online-based storage service we can store any kind of data such that photos, Microsoft document, text, audio, video files

We store our all document in Google drive.

Google Site: We publish a web page that contain our research related information on Google sites.

3.3 Data Collection Procedure

We are trying to find data in local business but they don't want to share their sales data with details. After that, we decided to find and collect sales data from online. After a lot of searches finally, we found a shareable data which is in excel format and well maintained.

Source:

https://d3ptjqwi47vj0c.cloudfront.net/webinars/pbi/power.bi_retail_analysis_webinar.zip

We download that which is a Demo sales database on Australia's Business. After discussion with our Supervisor, we change that data to Bangladeshi format. We do some changes on that data.

Data Changes are:

State Name = Change to Bangladeshi Division

Manager's Name = Change to Bangladeshi Local Person's Name.

Suburb = Change to Bangladeshi Place name.

City Name = Change to Bangladeshi City name.

Data Set:

In our dataset, it's a combination of 5 Tables. There are

1. Buyers / Category Table:
 - a. 10 Categories of Items are available in this table.
 - b. 10 Buyer's Names.
2. Managers/Suburb Table
 - a. 98 Suburb or place-name where the business shop or office available.
 - b. Manager of that Suburb.
3. Regions/ State Table
 - a. 8 Division
4. Financial Quarter / Dates Table
 - a. One Year is divided into four sections every section is a One Quarter.

5. Sales Table

- a. 74,466 entity Of Sales data with Date, Category, Chain, Total Unit, Sales price, Cost price.

Category	Buyer
Womens	Fakhruddin Ahmed
Mens	Iajuddin Ahmed
Kids	Kazi Zafar Ahmed
Juniors	Moeen Ahmed
Shoes	Shafi Ahmed
Intimate	Sahabuddin Ahmed
Hosiery	Yazuddin Ahmed
Accessories	Abdus Samad Azad
Home	Humayun Azad
Groceries	Golam Azom

Figure 4 : Category Data Table

A	B	C	D	E	F	G
76453	01-08-17 Ready Wear	2015 Kids		1851	5.41	3.02
76454	01-08-17 Ready Wear	3148 Kids		1557	5.81	2.96
76455	01-08-17 Ready Wear	2560 Kids		1074	8.47	4.2
76456	01-08-17 Ready Wear	2830 Kids		1312	7.52	3.9
76457	01-08-17 Ready Wear	4119 Kids		1712	5.98	3.18
76458	01-08-17 Ready Wear	2154 Kids		1536	6.2	3.06
76459	01-08-17 Ready Wear	2541 Kids		1742	5.84	3.05
76460	01-08-17 Ready Wear	3353 Kids		1258	7.92	4.02
76461	01-08-17 Ready Wear	3199 Kids		1341	8.1	4.39
76462	01-08-17 Ready Wear	2350 Shoes		486	21.91	11.35
76463	01-08-17 Ready Wear	3199 Kids		2625	4.79	2.83
76464	01-08-17 Ready Wear	6330 Kids		1757	6.05	3.12
76465	01-08-17 Ready Wear	2830 Kids		1985	5.92	3.19
76466	01-08-17 Ready Wear	3148 Kids		1393	8.52	4.3
76467	01-08-17 Ready Wear	2560 Kids		1978	6.4	3.17
76468						

Figure 5 : Sales Data Table

Data Relations:

In our Power BI Model Creation Section, we try to reduce data collection and redundancy for those reasons and doing our analysis more dynamic we create relationships within data table's fields. In Manager Table to Regions, Buyers Table to Sales, Dates Table to Sales, Sales Table to Buyers and Managers. [9]

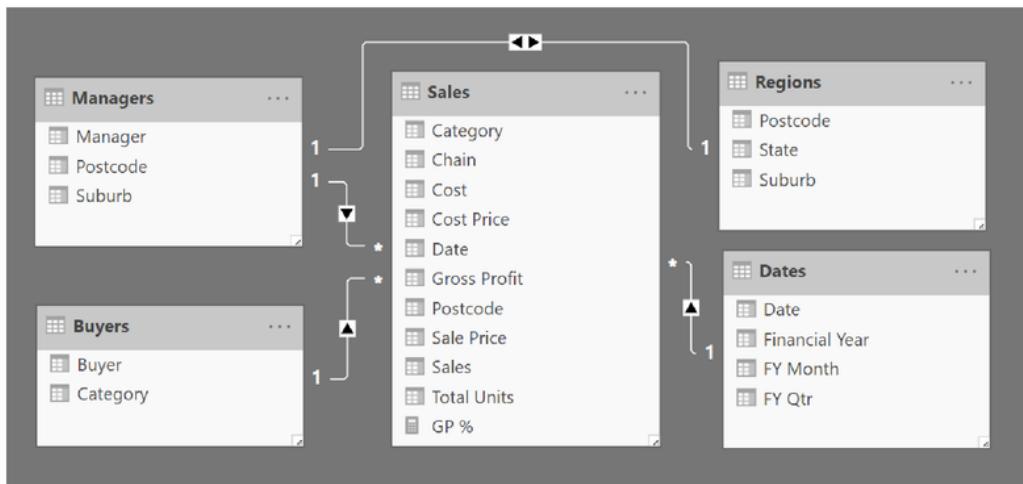


Figure 6 Data Table Relation

3.4 Equations: [10]

To archive goal and mining the right information model used some equation that's are:

$$\text{Total Sales} = [\text{Sales Price}] * [\text{Total Unit}]$$

In Power Query mode of power bi, there is a new column added and it's "Total Sales" which is multiplying of Sale "Price column" and "Total Unit column"

$$\text{Cost} = [\text{Cost Price}] * [\text{Total Unit}]$$

Cost Column is a result of multiplying cost price column and total unit column.

$$\text{Gross Profit} = [\text{Total Sales}] - [\text{Cost}]$$

Gross Profit is a profit that when total sales subtract by cost.

$$\text{Gross Profit \%} = \text{SUM} (\text{Sales} [\text{Gross Profit}]) / \text{SUM} (\text{Sales} [\text{Total Sales}])$$

Where Gross profit percent represents the sum of gross profit divided by totals sales

3.5 Implementation Requirements

Firebase Database:

For developing our model into real implementation we need firebase database access and we need an account of Google firebase database. [7]

Mobile Application (user end):

We need a mobile application that collect our sales information from sales person.

Online API of Firebase Database:

Model Required an API that access firebase data and can we used in our power pi application.

Power PI application:

For Creating Model, Drill Down our data, Data Relations, Visual Analysis, We a Microsoft Power BI Application.

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Introduction

After Doing This Experimental we found some facts and decision. Visualization of a simple excel data to human-understandable and usable data that can we used in our decision making support system.

4.2 Experimental Results

Data Model: From Excel Simple Row Data to we create a Data Model that create a relationship with one table to another table.

Drill Down Data: We sort our huge data to the small understandable data. We drill down our data. By sorting and customizing. [3]

Data Filter: We can Easily Filter our selected data from huge amount of data.

KPI Chart: Total Sales figure with the background trend of sales by dates. At a Glance, this board showed the total sales with background timeline chart. Which is very important for our business executives.

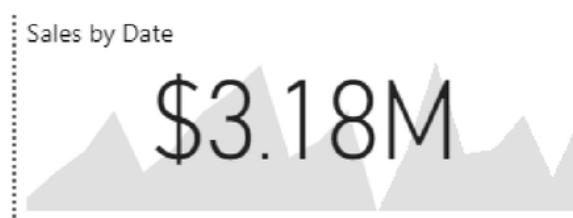


Figure 7 : KPI Card

Line and Stacked Column chart: Sales and gross profit by financial quarter with a line and stacked column chart. Indicate the sales and profit in that period of quarter. Stacked Column Show the Sales growth with financial quarters and Line within the stacked column present the gross profit according to sales by using the gross line.



Figure 9 : Line and Stacked Column chart

Clustered Column chart: A clustered column chart is a combination of State sales data with the chain. It shows the total sales by the state with the chain. In our clustered column chart we found which division acquire most of the sales with ready wear and bellings sales.

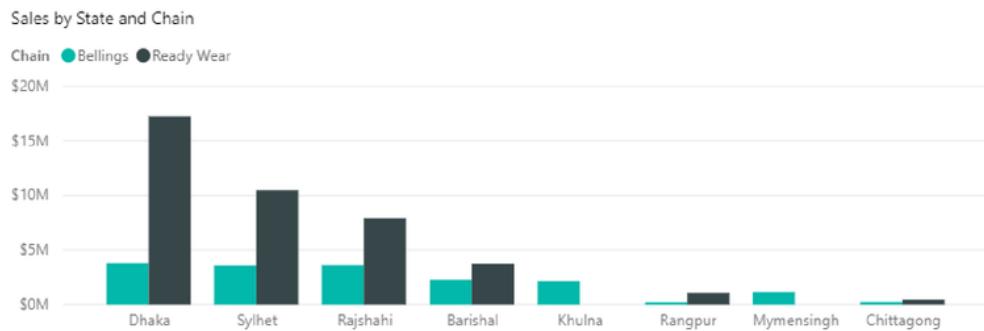


Figure 8 : Clustered Column chart

Map View: It can show which division are most sales with a geographical map view.

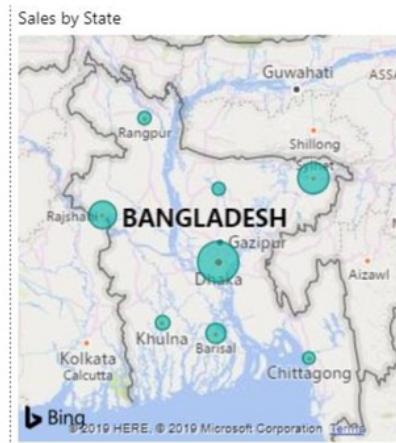


Figure 10 : Map View

Sales by Category and Chain

Chain ● Bellings ● Ready Wear

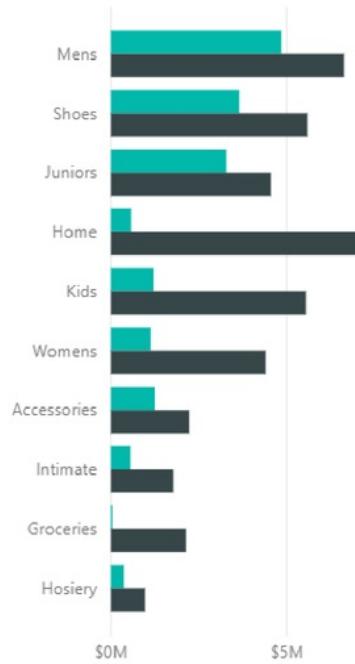
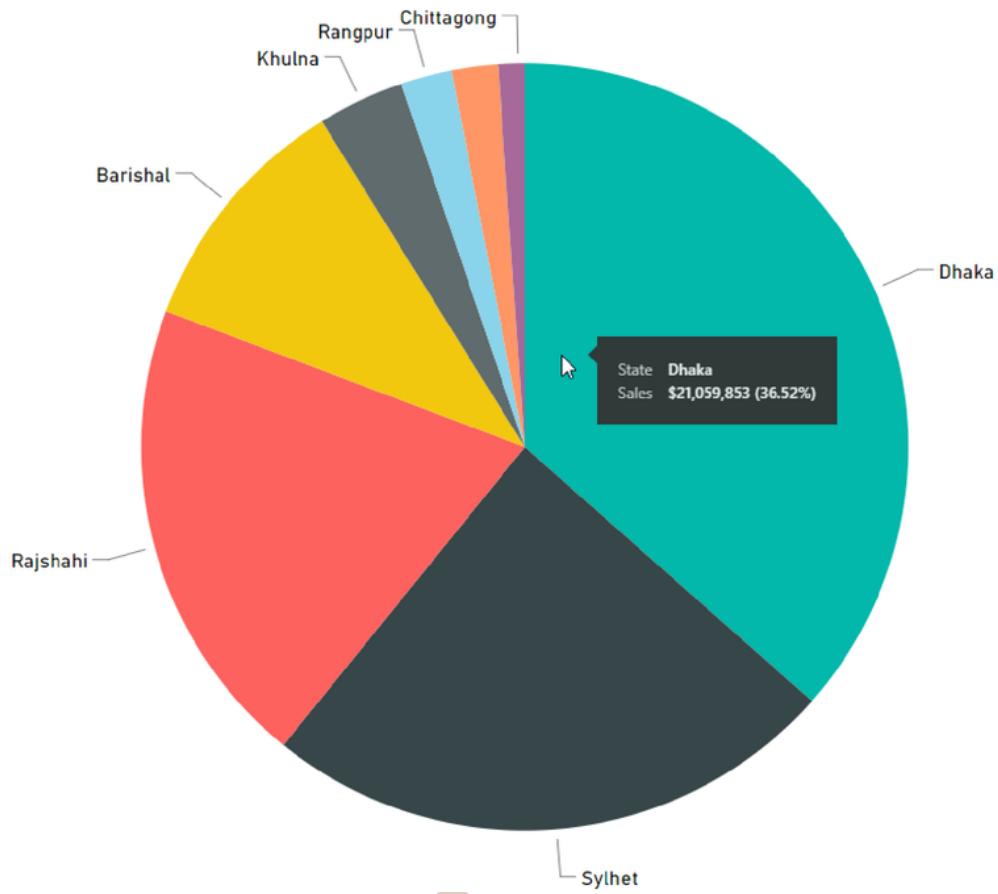


Figure 11 : Clustered Bar chart

Clustered Bar chart: This is also known as a group bar chart that can show some group of data at a single view of the chart. Our Sales Category and Chain data are combined in the clustered bar chart. In this chart, we can see which type of category sales are mostly done by chain.



43
Figure 12 : Pie Chart of Sales Data

Pie Chart of Sales Data: With our Experiment we get a pie chart which is a Sales by Division chart.

Data Trends: Analyzing all data we can now understand the data trends that means now business owner or executives can understand sales trends.

Decision Support: Visualizing all data at a time and study about previous data they can easily make a decision what kind of action they can take.

Multiple Way of Access: Our Experiment is open a door that can visual the sales data in many ways by category sales, by managers, by regions, etc.

Cross Connected Data: This Model is not only produced a visual view of data it's dynamically all data are connected and cross-connected report are automatically generated.

4.3 Descriptive Analysis

Doing the experiments we found some Graph, Chart Using This graph chat we make our mission faster than the ordinary report of sales.

KPI Analysis: Key Performance Indicator is played a vital role in any business. By analysis KPI, we can understand our business situation. So our model provides KPI that very helpful to business.

Pie Chart Analysis: We know that the pie chart is so much popular way to visualize data at a single sign. Our sales data by division easily can view on pie chat which shows which division sales most and their percentage.

Scatter Plot Analysis: Our Model provides a scatter plot that indicates our financial quarter and category with a two-dimensional data business executives can easily understand what was gone in their previous sales and current business situation and may predict some future imagination of sales. [11]

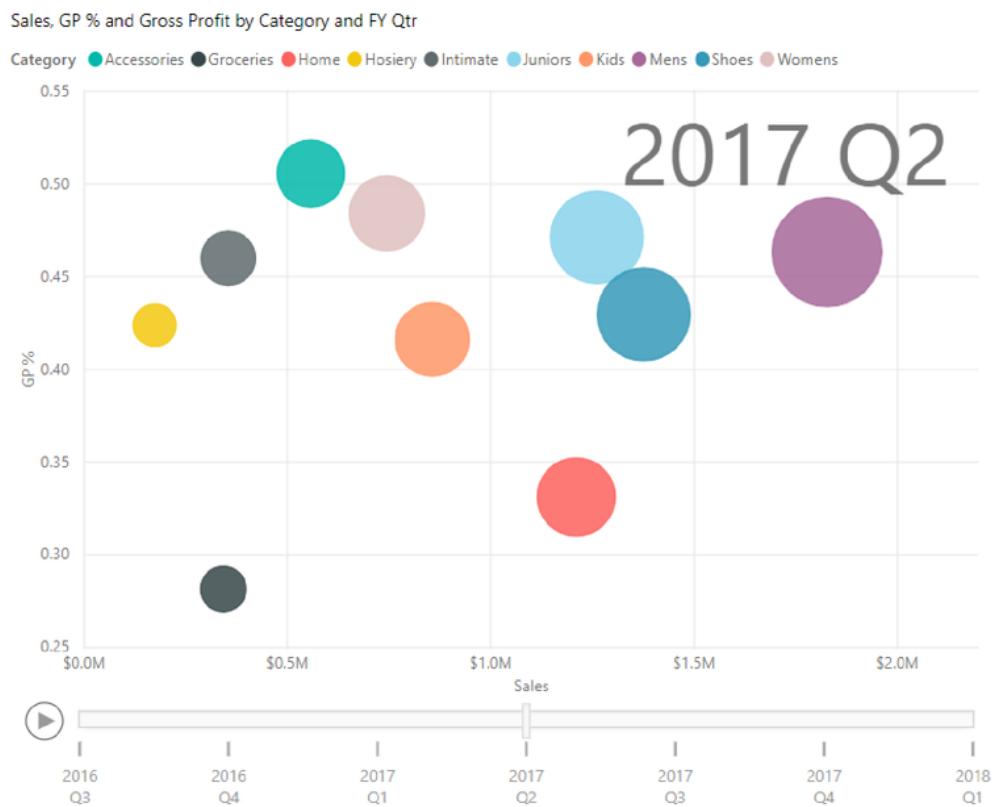


Figure 13 : Scatter Plot

4.4 Summary

The proposed model generates many charts, a graph that helps business executives to take wise and data-driven decision so can say that if it creates a positive impact on business then our research will be success.

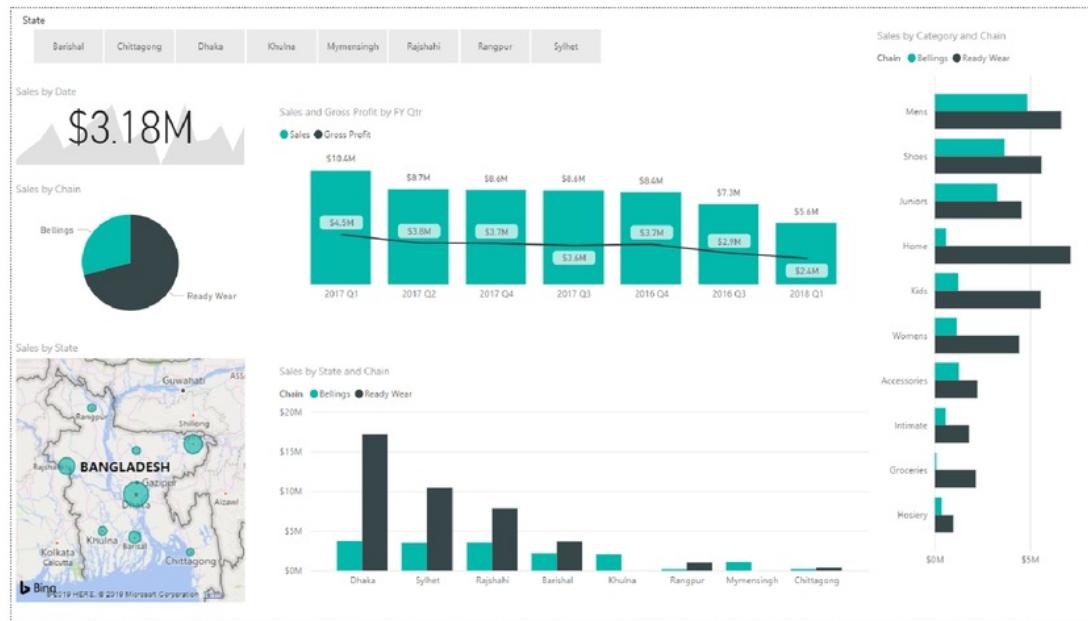


Figure 14 : Power BI Dashboard

¹ Chapter 5

SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

5.1 Summary of the Study

Consider modern technology competition with market competitors and tackle with update data with Control a vast amount of data for business decision-making process need to be more fast and efficient. From that perspective this research containing five steps procedure with lots of experiments such as data trends, decision support, Compatibility, Multiple Way of Access, KPI analysis, Descriptive analysis also Data Model, Data Manipulation, Drill Down our Data, State Filter Section finally decision making visualize with variable chart modules. Applying this method can make a successful impact your organization's strategic business investments advantage of industry likewise Industry trends or business trend also make an alternative decision which affected by changes in the smart Business Intelligent environment in the business.

5.2 Conclusions

In conclusion, BI has a big impact on the IT industry. Every corporate organization who manages insights into their data, strategies, profits, and performances thus BI help them to make significant and complex decisions. This paper represents important facts about data collection, storage, processing, and visualization output. The main solution mainly based on power BI insight where table relationship and data-driven culture by enabling everyone to turn data into insightful visualizations they can use to make business decisions quickly and confidently.

5.3 Implication for Further Study

This proposed model uses lots of modern technologies but day by day our technology changed rapidly so it's not enough to just stay with old technology. Day by day various new complex and complicated issue is applied in our business and that can change the business strategy and functions so for more update and error-free model and technology will be needed. So as our model we are trying to stay with update technology. But its need a further study like new core programming script implication. Direct data connection and more.

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APPENDICES

Appendix A: Research Reflection

The purpose of this Appendix is to provide an introduction to Research refection. For doing this research we face lots of issues like data related, process-related and some real-life situation, this is a University Final year thesis experiment. We are a small group of student and our Supervisor try to find some solution that our daily business executives and business analytics face. Our proposed model is based on the real-life scenario so we think that our prosed model maybe suited in our business execution. During work in this research, we found there is lots of information gap are available in researcher and business executives. We try to narrow down that gap. As a result, we found a successful model that actually developed for business execution.

Appendix B: Related Issues

This proposed model used Power BI Version: 2.71.5523.941 64-bit (July 2019) Power BI Rapidly update their Application Every month. So Some Data Confection and Error may be happening. As Storage, we discuss Google Firebase Which is a Real-time Online base Database and Storage system it has some limitation like Free user can handle a limited amount of data and its service charge may be changed any time. Our business strategy also changes day by day so maybe our graph chart not workable in every situation.

Demonstration of Project:

<https://sites.google.com/diu.edu.bd/diubi/demo?authuser=0>

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31
