Illustrative BI Solution to Improve Marketing Strategies: Case Study

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Abstract— **Marketing strategies such as pricing and advertising determine the competitive performance of a product and a business as a whole. Critical analysis of these strategies is therefore vital to boost a company's performance in a competitive environment. Recent influx in data volumes coupled with stiff competition have necessitated the use of visualizations and faster data transformations prior to analysis. This is because of the need for quick, timely, competitive and facts-based decision making. In this paper, marketing strategies are analysed through their influence on sales and overall performance. Research analysis has been done using SSDT-BI for transformations and Tableau for visualizations. Visual and statistical analytics has revealed the influence of price difference and advertising costs on sales. High advertising budgets have proved to be the way to maintain high sales with a negative price difference. Sales can also be maintained with a minimal negative price difference. Recommendations have pointed to minimising price differences, improving shelving facilities and opportunities for opening new sales outlets.**

Index Terms— **Business Intelligence, SQL Server Data Tools, Tableau, Data Visualization**

1. Introduction

In a competitive and dynamic environment such as the manufacture of baby products, it has always been a challenge to access timely information and understand the pulse of the customers. Although all major businesses employ Business Intelligence (BI) and it has evolved over the last few decades, it is still deemed as a major problem due to the inability to obtain meaningful insights within a short time (Park, Sawy, & Fiss, 2017). Different BI tools have been developed to ease the analysis of data for the managers and several visualization tools have been developed in order to present data in a graphical form (Diamond & Mattia, 2017). Theoretically, visualizations help to quickly draw actionable insights from data but this is still in its early phase mainly due to the data quality issues (Marjanovic, Dinter, & Ariyachandra, 2016). Data viz has been developed based on the fact that the human brain understands and interprets visualizations faster than real figures (Hsuanwei, 2017).

This research paper is a case study of a global car baby seat manufacturer with sales outlets in the United States of America (USA) as well as in other places. It is cited that the overall sales have reduced tremendously and hence the manufacturer wishes to increase the unit sales by 1000 especially in the poorly performing sales points in the USA. Although, the advertising expenses in certain locations have been noted to be extraordinary, it was seldom reflected in the sales. The advertising costs should be justified in terms of the Sales-to Advertising ratio (SAR). The KPI of the SAR is set to a value of 1.5 and every sales point is required to meet this SAR On the other hand, the sales points without any advertising expenditure and with sales above 5000 units are exempted from this KPI. Those locations with SAR less than 1.5 are considered to be performing poorly.

A different approach to evaluate the performance of the outlets in terms of the Key Performance Indicators (KPIs) was needed. This study therefore seeks to analyse and improve the marketing strategies so as to boost the overall competitive performance of the company. Furthermore, these advertising expenses need to be justified in terms of sales in each location. Therefore, as much as advertising is a crucial competitive strategy, a clear relationship needs to be established in order to explain how sales is influenced by all the marketing strategies.

2. Materials and Methods

This section briefly describes the dataset that serves as an input to evaluate the sales performance of various sales locations. It also contains a discussion of the recommended tools and techniques used to produce the illustrative BI solution.

2.1 Metadata

The dataset of the car baby seat manufacturer includes the data of 400 sales locations. Each observation represents a sales point and it either belongs to USA or elsewhere. The data also reveals whether a sales point operates in an urban centre or not. The metadata and their description of all the attributes are shown in Table 1.

Table 1: Metadata of Car Baby Seat Sales Income and other details

Attribute	Description
Location Id	Identification number to uniquely identify the location of the outlet
Sales	Unit sales of car seats for each location
Competitor Price	Price charged by the competitor at each location in dollars
Income	Community income level in dollars
Advertising	Local advertising budget for the company at each sales location in dollars
Population	Population size in region
Price	Price charged by the company at the sales location in dollars
Shelve Location	Category with levels (Bad, Medium and Good) indicating the quality of the shelving
Age	Average age of the local population.
Education	Education level at each location.
Urban	Indicates whether the sales point operates in an urban centre or not
USA	Indicates the location of sales points

2.2 Analytical Tools for BI Solution

A good BI solution is one that uses a combination of tools to consolidate all the data provided in a way that makes it easy for managers to draw actionable and fact-based insights (Larson & Chang, 2016). It should guide managers into making confident and strategic business decisions in the most efficient way (Nedelcu 2013; Park, Sawy, and Fiss 2017). Business intelligence creates business value from the currently high valued business data by revealing challenges and opportunities (Trieu 2017; Fink, Yogev, and Even 2017). Diamond & Mattia (2017) cited different business visualization tools such as Microsoft Power BI, IBM Watson Analytics and Tableau.

This report recommends a combination of tools such as Tableau 10.5 and SQL Server Data Tools-Business Intelligence (SSDT-BI). SSDT-BI is apt for its diversity of transformations. It is mainly used to perform Extract, Transform and Load (ETL) operations. ETL operations are concerned with extracting data from different sources, cleaning these data, transforming data into forms as needed by the data warehouse and loading data into the data warehouse (Sirin & Karacan, 2017). SSDT-BI is therefore proposed to facilitate simplified and timely creation as well as access to clean and consolidated company data.

Tableau has been chosen due to its abilities to create meaningful and interactive visual dashboards using a modest codeless approach. Tableau also suits different organizational needs as well as different data formats and sources. In terms of suiting different organizational needs, individuals can affordably use the Tableau desktop while enterprises can go for the Tableau server. In terms of different data sources, Tableau works with over 40 data sources such as file-based data sources (e.g. excel, csv), relational database data sources (e.g. Teradata and SQL server) and cloud-based data sources. Furthermore, tableau also has an in-built Extract, Transform and Load (ETL) mechanism. Tableau has been used to visualize the company's performance in the different sales locations with respect to customer perceptions. This has been done with the help of graphical representations and dashboards. Airinei & Homocianu (2017) acknowledged visualizations for simplifying business data analysis with the help of such graphical representations. With these visualizations like a dashboard, business overall performance in the different sales locations has been synthesized and can be viewed interactively in a single interactive or animated dashboard. Tableau is therefore proposed for its ability to use different visualizations to delineate figures in a form that managers can easily get insights from such data (Marjanovic et al., 2016).

3. Design of a BI Solution

This section contains the design of the proven BI solution. The initial step was to clean and modify the data according to the needs and hence ETL operations were performed using SSDT-BI and the transformed data was loaded into Tableau for further visualization and exploration.

3.1 ETL Logic

SQL Server Integration Services (SSIS) was employed to perform ETL operations on the dataset. Conditional split was used to split the data according to whether the location was in USA or not as the focus of this BI solution is merely on sales points operating in the USA. The ETL operations were carried out on the original dataset as shown in Figure 1. The dataset was first split into two

groups to separate those locations which belong to USA from those which did not. Since the focus is exclusively on sales locations that belong to the USA, further ETL operations were performed on this split dataset. These locations were further sorted in ascending order of their unit sales to easily see those ones performing poorly in terms of unit sales.

Figure 2 displays the initial records of the destination file and it clearly shows that the location 1000166 has the lowest unit sales. A new column was derived for the price difference by calculating the difference between the competitor's price and the company's price. This derived column can be seen as the last column in Figure 2. This ETL operation was intended to align these price differences with the sorted sales locations. It was also intended to provide initial insights about whether this difference has a relationship with the sales. Preliminary exploration shows that the location with the least sales has a very high price difference as compared with that of the competitor. This could be a potential reason for the very low unit sales in this location.

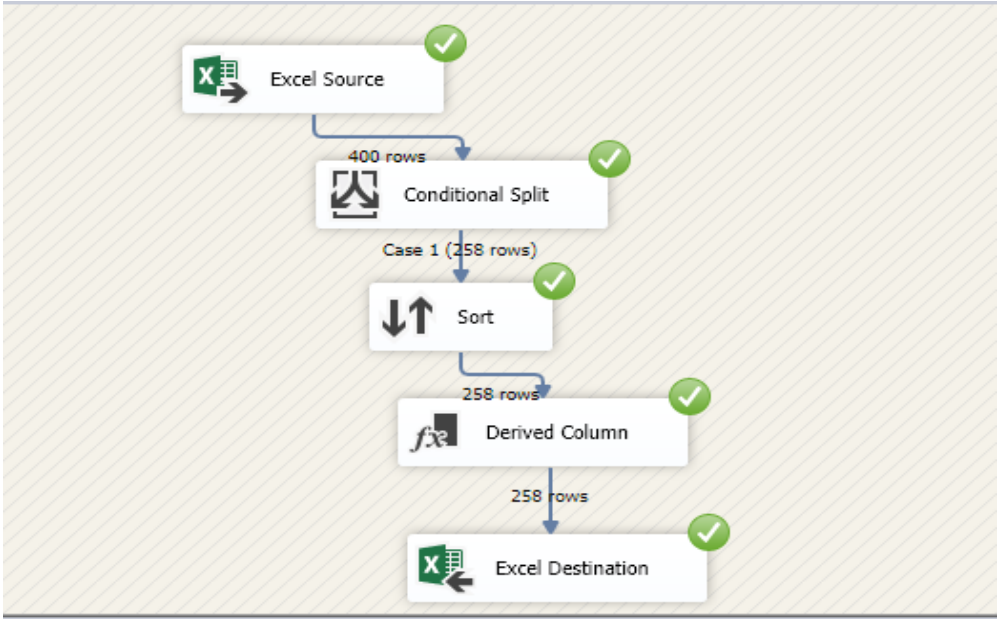

Figure 1: Data flow interface of ETL process

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Location ID	Sales	Competitor Price	Income	Advertising	Populatior	Price	Shelve Location	Age	Education	Urban	USA	Price Difference	
2	1000166	370	147	58000	7000	100000	191	Bad	27	15	Yes	Yes	-44	
3	1000144	530	122	88000	7000	36000	159	Bad	28	17	Yes	Yes	-37	
4	1000051	1420	99	32000	18000	341000	108	Bad	80	16	Yes	Yes	-9	
5	1000063	1820	139	45000	0	146000	133	Bad	77	17	Yes	Yes	6	
6	1000216	2340	116	83000	15000	170000	144	Bad	71	11	Yes	Yes	-28	
7	1000325	2660	136	65000	4000	133000	150	Bad	53	13	Yes	Yes	-14	
8	1000035	2670	115	54000	0	406000	128	Medium	42	17	Yes	Yes	-13	
9	1000281	2860	121	86000	10000	496000	145	Bad	51	10	Yes	Yes	-24	
10	1000162	2930	143	21000	5000	81000	160	Medium	67	12	No	Yes	-17	

Figure 2: Sample Table of Destination File

3.2 Data Visualization

Tableau helps business managers to quickly draw actionable insights from the data. In this report, the output of the ETL operations which is the destination file has been imported into Tableau. Tableau has then been used to visualize the performance across the entire USA market. Graphical visualizations have been used to delineate the performance of each sales point in terms of sales, advertising budgets and pricing. Customer perceptions in the different sales locations have also been visualized. Sales locations can also be visualized according to whether they operate in an urban centre or not and how their shelving is perceived by customers.

The different attributes of the sales locations can also be filtered and observed in different perspectives. This means that it can be filtered through the different variants of these attributes and observe what happens to the rest. This has been done with an interactive Tableau dashboard. For instance, all the sales points with a "Medium" shelving perception can be viewed. In such a view, it can also be observed about how many operate in an urban centre or not. Furthermore, their trend of sales performance can also be seen.

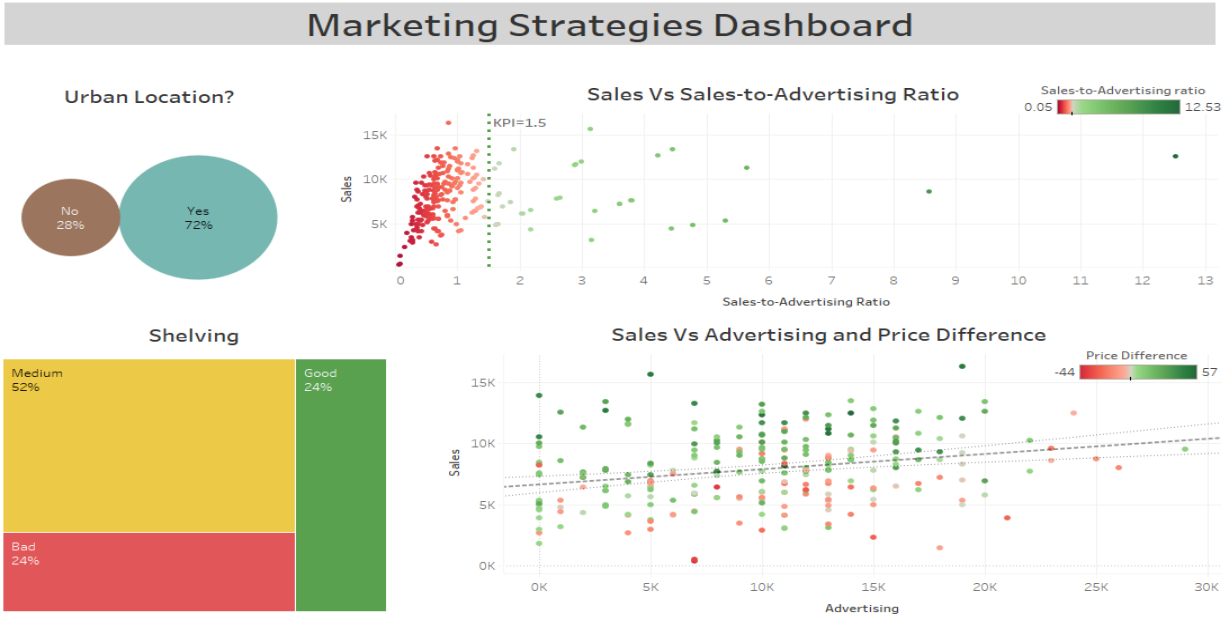

Figure 3: Overall Dashboard for Marketing Strategies

4. Results and Insights on the Impact of Sales

The data visuals and the dashboard provide several insights to understand the effect of various marketing strategies on sales. Initially, it was found that customer personal attributes such as age and income had no significant impact on sales. It was also revealed that the population of a location also does not affect the sales significantly as shown in Figure 4.

The KPI is to have a minimum of at least 1.5 for the parameter of Sales-to-Advertising ratio. However, astonishingly, it can be seen from Figure 3 that most of the outlets are far behind this KPI achievement. In fact, the average SAR for all the outlets is merely a 1.1 although a particular outlet can be singled out for achieving a SAR of 12.53. This is clearly the outlier as the median is far lower than the mean with a value of 0.74. These confirm the seriousness of the plummet in sales as well as the intensity of the sales locations which exhibit the same pattern. The feature that is closely relating to sales and advertising is the price difference of the products sold. 258 observations were modeled to compute a linear trend model for Sales given advertising as shown in Figure 5. The model may be significant at $p <= 0.05$. The trend can be described as in Table2.

In general, the trend line denotes an increase in sales with a proportionate increase in advertising costs. However, the increase in sales is not merely based on advertising strategies alone. The colors in the visual denote the price difference among the different competitors. Red color indicates higher price and green color indicates lower price compared to competitors' pricing strategy. Considering all these three attributes together, the upper half of the visual in Figure 5 is mostly populated with green thereby attributing to the fact that price difference attributes to increase in sales and it may be slightly varied with or without the support of advertising. It is thereby revealed that as the price difference increases, the sales in the different locations increase. Therefore, the sales sites where the price difference is positive show higher sales achievement as compared to the rest. In other words, the sales dropped in locations where the prices are higher than that of the competitors.

Furthermore, it could be seen that there are selected outlets which have a negative price difference and yet showcase good sales amounts. Probing further, these results just attribute to another important factor which is the shelving of the product. From a general perspective of all the sales locations, it was revealed that the company is not doing well in their shelving with only 24% sales sites having good shelving locations. Further insights reveal that some sales sites showed high sales without any advertising budget at all. This is very good for the company since profits from such sales sites can be used to

cover the expenses in poor performing sites. It is also revealed that some sales sites have very high sales but still did not reach the KPI of 1.5. This is a sign of stiff competition in such locations in which continuous advertising is the only way to maintain the sales (Darrat, Wilcox, Funches, & Darrat, 2016). To sum up, higher sales is often attributed to a good price difference. But, on the other hand, if the price difference is negative and minimal, the sales can still be maintained if the product has good shelving. With a high negative price difference, high sales can be sustained only by heavy budget allocation for advertising. Nevertheless, there is no significant difference between urban and rural locations. However, rural is influenced by the price difference more than the advertising which is vice versa in urban sales points.

From the proposed BI solution, the following recommendations have been proposed for the company to improve its performance in the various sales locations. These recommendations will help the company to further pursue its strategic business objectives as it aims at being the leading producer and supplier of car seats. Therefore, as part of BPM strategy, the company should consider the following recommendations: i) Minimize the price differences since it is evidenced that locations with higher price differences have lower sales. Several studies have confirmed that pricing has a big impact on sales and revenue (Jiang, 2016). This is an opportunity for the company to boost its sales in such locations and maintain customer loyalty as well. Farm (2017) also confirmed that companies that aim at competitive price leadership always keep their prices low which gives them a competitive edge. ii) Improve the shelving facilities to boost sales in the poorly performing locations. The percentage of locations with bad shelving mostly outweigh than that with good shelving. The company should improve their shelving in such locations to attract more customers. iii) Opportunity for new sales outlets: it has been revealed from the dashboard that some sales locations make a lot of sales yet they do not incur any advertising costs to the company. This reveals investment opportunities in such locations and so the manufacturer should consider expanding more outlets in such locations.

Table 2: Description of the Trend using Linear Regression

Equation:	Sales = 0.124349*Advertising + 6622.45			
Coefficients				
Term	Value	Standard Error	t-value	p-value
Advertising	0.124349	0.0293796	4.23247	< 0.0001
intercept	6622.45	341.4	19.3979	< 0.0001

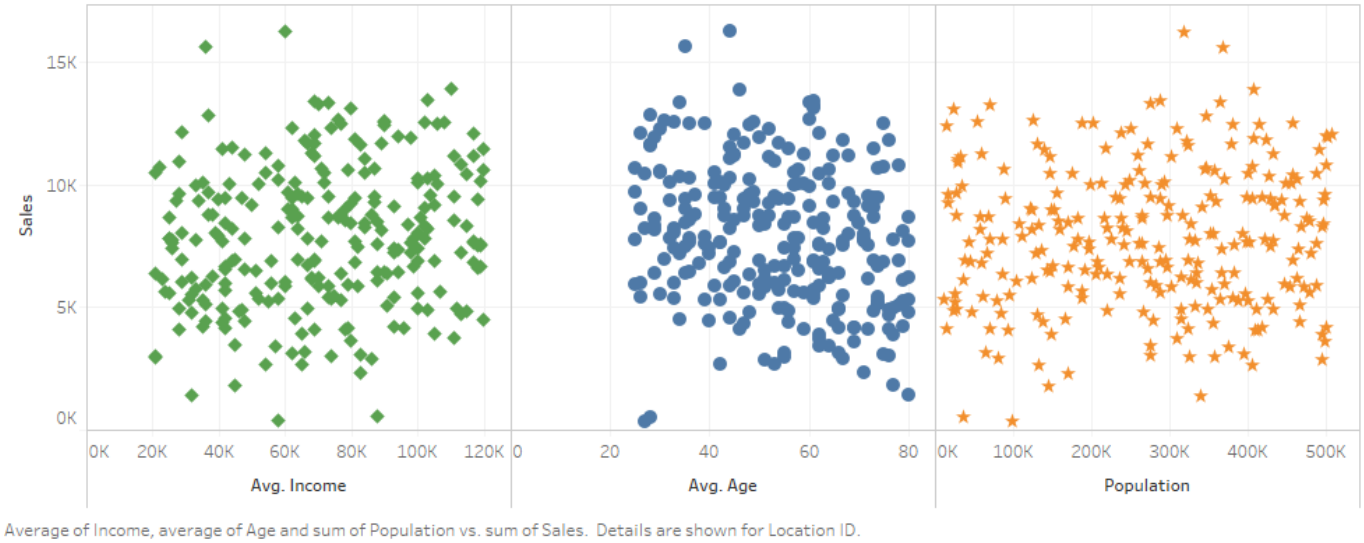

Figure 4: Effect of Income, Age and Population over Sales

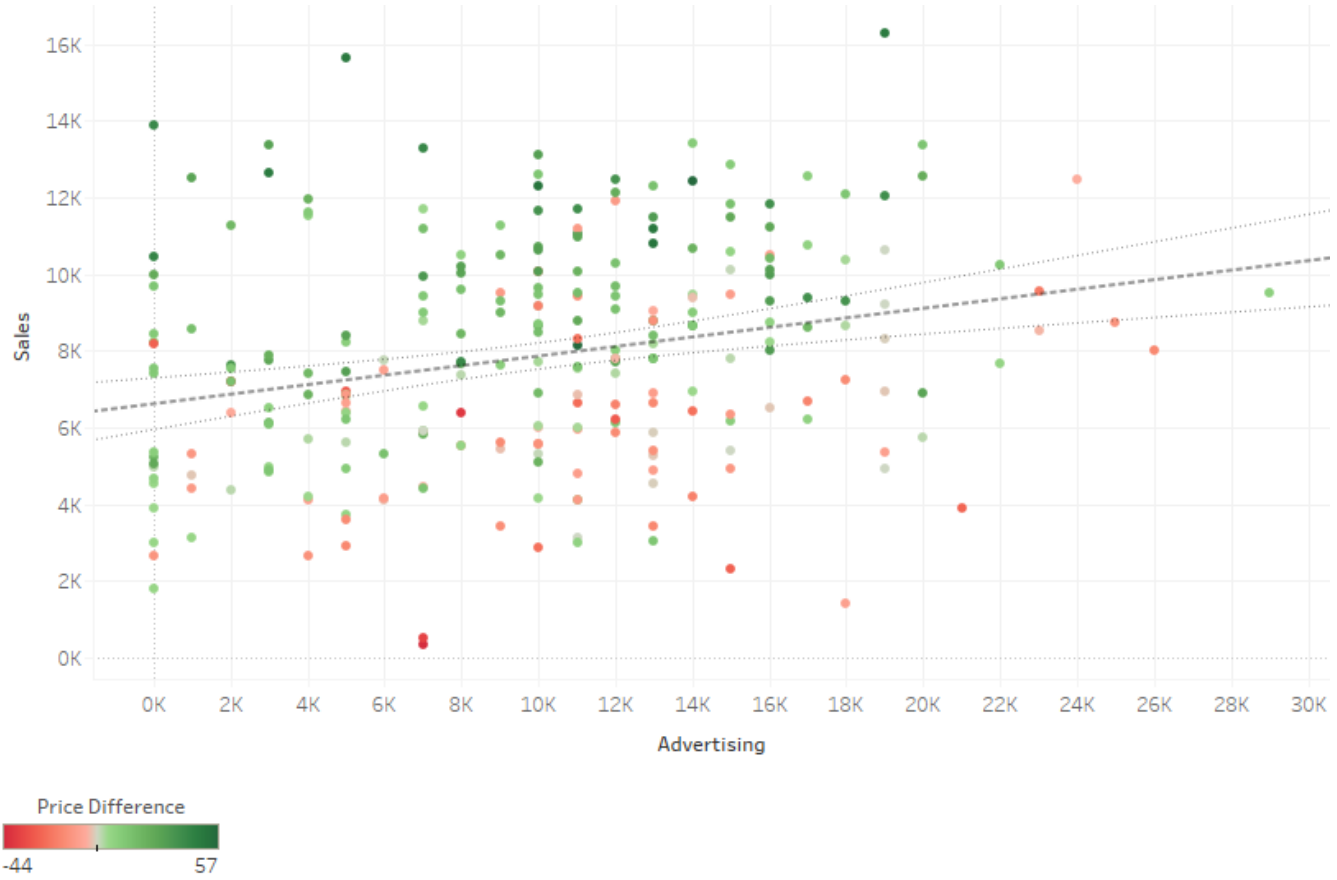

Figure 5: Sales vs. Advertising and Price Difference

5. Conclusion

The designed illustrative BI solution has worked on converting the raw data into quality datasets that can be used for further analysis. The solution analysed and revealed the weaknesses of the current marketing tactics and its effect on sales and KPI achievements. Detailed analysis on the poorly performing outlets has also revealed the other causes for the decrease in sales. Recommendations have been provided to improve the marketing strategies of the car baby seat manufacturer in the USA. This case study is an attempt to make businesses view the practicality of using the latest technologies and advancements in data visuals for the process of improving their business intelligence solutions.

Appendices

Data Source: https://www.kaggle.com/c/carseat-sales/data

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