PEPSICO

# An optimization analysis about advertising campaign of PepsiCo

# Presented by:

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## Summary

**"PepsiCo Trims Nonessential Advertising and Marketing Spend as COVID – 19 condition continue" – Ad Age April 28, 2020.**

The article above inspired us to create an optimization model to maximize PepsiCo's Brand Awareness with minimizing the overall advertising spending. This novel coronavirus has forced not only small-scale businesses but also large scale to rethink about their spending and also find new ways to stay afloat. Advertising and Marketing are the core of any Fast-Moving Consumer Goods Company and how much PepsiCo and Coco Cola spend on them is also quite ubiquitous. Due to the COVID -19 situation, the relevance of many advertisement channels has been lost, also sales are declining for many products. The marketing team at PepsiCo will not only think about increasing their presence on various Advertisement platforms but will also resort to lessen the spending so that the company doesn't incur losses.

Our team researched about how much PepsiCo has been spending on advertisement all through the years and we also thoroughly researched about the cost of advertising on various old and modern advertising channels. Also, we took time to understand the preference of the target audience regarding the various advertisement platforms as age plays a major factor in the choice. Using this data, we created a Maximum exposure or brand awareness optimization model for various advertising channels and also minimum advertising cost optimization model for various social media platforms which helps PepsiCo's marketing team to choose the right medium for advertising its products and also keep the cost in check.

We used Microsoft Excel Solver and Solver Table add in for creating these optimization models. Also used sensitivity analysis to understand the cause and effect of varying constraint values on the decision variables.

# Introduction

## Company

PepsiCo Inc is an American multinational food, snack and beverage cooperation. It is known for a highly diversified product portfolio for both the beverage industry and consumer packaged industry. More than half of the business revenue comes from the snack food category. The company's business model depends on aggressive marketing such as advertisement. In the year 2019, as per Marketing Dive(website), PepsiCo increased advertising and marketing spending by 12%, this aggressive strategy worked out for the company as the net sales rose to 4.3%. The company makes multi- medium advertising work with a combination of TV, digital, social media, out of home such as billboards, etc. Also, PepsiCo is developing an inhouse media and consumer data that works on data to generate insights for better business operation. PepsiCo spent around 2.9 billion dollars on advertisement and 4.1 billion dollars for overall marketing in 2019.

## Problem

Although it is required for PepsiCo to spend aggressively on its advertisement as it helps to keep up with the competition, to stay viable in the market as a snack and beverage company they will have to spend and it also increases sales. But due to COVID-19, PepsiCo decided to use its

advertising money wisely as sales of beverages have seen a decline compared to the sales of snacks. As a team we planned to help PepsiCo to minimize their total advertisement expenses or at least keep at the same level which is $2.9 billion dollars and get maximum exposure in the year 2020. We have chosen to study advertisement expenses on 6 different mediums – Newspaper, Magazines, Radio, TV, Internet, Outdoor as there is Comparative Media Costs provided by the Stanley Report in which the cost for each ad per thousand impressions (CPM) in newspaper is $16, $16 for magazine, $10 for Radio ,$30 for television and $5 for outdoors and $3 on digital platforms. In the past, Television served as an important medium for advertisements but with the emergence of internet and streaming services, potential customers have moved away from the medium. So, PepsiCo also needs to ensure that it reaches all those viewers. According to Forbes, PepsiCo traditional target market is teenagers and adults from the age of 18-45, so they have to choose wisely their mediums of advertisement. We have also researched data which give us an idea about how many exposures PepsiCo can get on different mediums based on the age of the target audience. Exposures a serve as an important criterion for optimizing of the advertising budget.

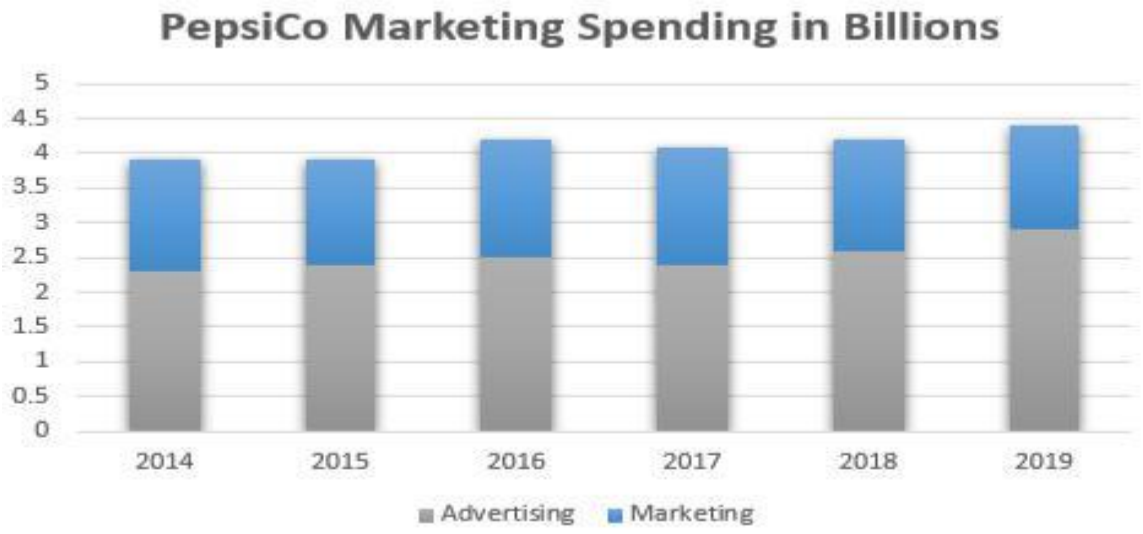
Also as a team we tried to focus on social media platforms PepsiCo can choose for effective marketing, keeping in mind the CPM cost per thousand expressions which is $7.19 for Facebook, $ 9.68 for YouTube, $7.91 for Instagram, $6.96 for LinkedIn and $ 6.46 twitter. Although PepsiCo’s budget is very high, but we still wanted to see how many ads we can purchase on each social media platform which can help in minimizing the overall spending on these platforms.

# Main Chapter

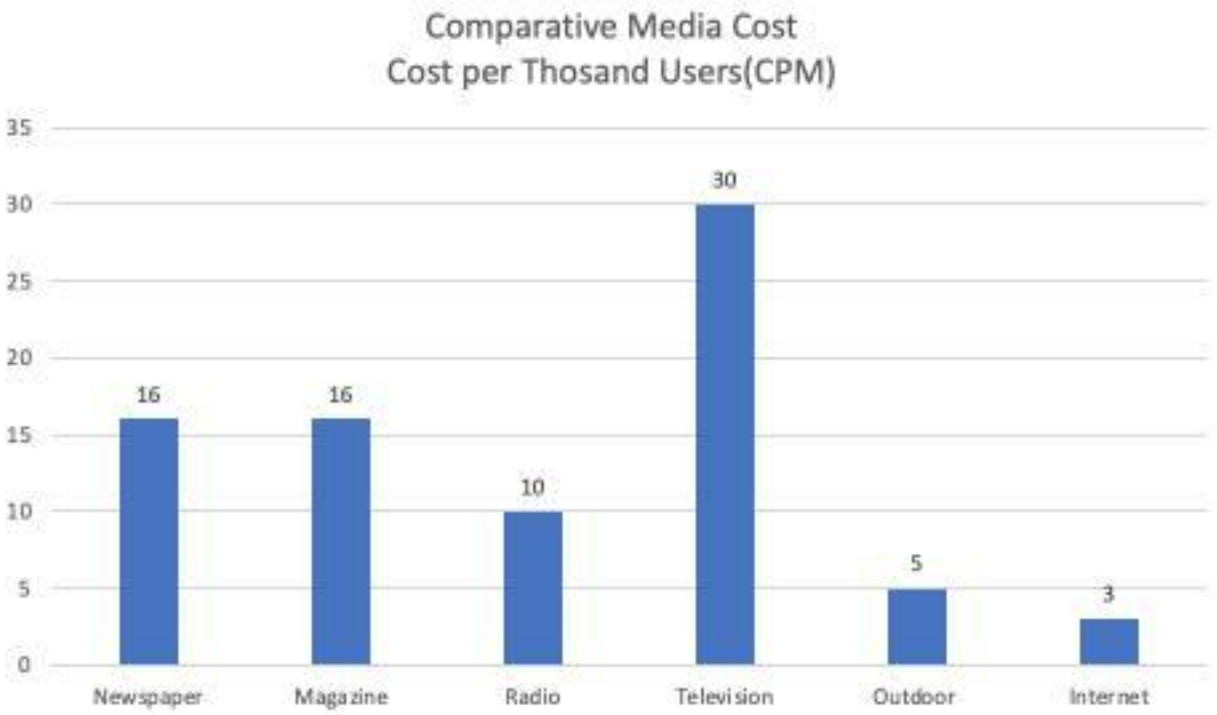
## Data Collection

Companies like PepsiCo are well known not only for their products but also for their advertising spending and we were able to find the data on various business news outlets and also some websites related to business and advertising. We started our research from how much PepsiCo has spent on marketing and advertising over the years. We looked at the data from the year 2014 till 2019 and we were able to derive the budget for the advertising budget for the year 2020.

| Year | Advertising Spending in Billions | Total Marketing Spending in Billions |
|---|---|---|
| 2014 | 2.3 | 3.9 |
| 2015 | 2.4 | 3.9 |
| 2016 | 2.5 | 4.2 |
| 2017 | 2.4 | 4.1 |
| 2018 | 2.6 | 4.2 |
| 2019 | 2.9 | 4.3 |



While researching about cost involved in advertising on different media channels, we came across Stanley Comparative Media Cost, which provides the cost per thousand users.




Also, there is huge data available these days on internet regarding the cost of advertising on various digital and social media platforms. There are two types of cost involved when you advertise on these platforms one is Cost per Click (CPC) and other is Cost per thousand impressions(CPM), for the purpose of this optimization study, we took into account only CPM.


## Data Analysis

One of the most important goals of any advertising campaign is aiming it right. Demographics play a major role in the understanding the advertising cost as the main purpose is to target the right audience. In this case, PepsiCo targets its audience on the basis of age. Different age groups have a preference for different mediums like people from the age of 40 and above read newspapers, but people from the age 18-35 also read newspapers but most of them read them digitally. Although PepsiCo's target market is 18-35-year-old but through its advertising it tries to attract people of all ages and choosing the right medium that gives the maximum outreach at a at a specific budget comes with its share of difficulties. Also finding the data which gives us an exact picture of which age group uses which media more was a difficult task, but various articles on the internet came to our rescue providing us with the percentage of the usage not the exact figures.

For the maximum exposure on different channels of advertisement optimization model, we did the following:

1. Divide the customers into different categories on the basis of their age. We didn't take into customer gender into account as we believe that the products of PepsiCo and the likings of these products have no relation to the gender.
2. Identify the customers preference of a advertising channel based on their age and usage to understand the total number of exposures (see the advertisement) we are getting currently for each channel(newspaper, television, internet etc.)
3. Finalize the minimum number of exposures PepsiCo can get from each different mediums or advertising channels.

We followed the same steps for the minimization of total cost to be spent on the digital marketing.

**Number of exposures are expressed in millions.*

**Due to COVID-19 advertising channels such as Radio and Outdoor have lost their exposures as less people are going out.*

| **Target Audience per Platform in millions** | **Newspaper** | **Magazine** | **Radio** | **TV** | **Outdoor** | **Internet** |
|---|---|---|---|---|---|---|
| Customer aged 5-15 years | 1 | 1 | 0 | 5 | 0 | 2 |
| Customer aged 16-25years | 2 | 1 | 0.2 | 6 | 0.1 | 7 |
| Customer aged 26-35years | 2 | 3 | 0.1 | 5 | 0.1 | 8 |
| Customer aged 36-45 years | 5 | 2 | 0.7 | 4 | 0.6 | 5 |
| Customer aged 46-55 years | 4 | 1 | 0.8 | 2 | 1.3 | 4 |
| Customer aged above 55 years | 2 | 1 | 0.1 | 1 | 0.4 | 2 |
| Cost per thousand users(CPM) | 16 | 16 | 10 | 30 | 5 | 3 |

**Number of exposures are expressed in millions. We have not taken exposures in 100 millions as we don't specify any budget in this case.*

**Not all advertisements are shown to all the users, every websites have a different strategy. So we have not taken all the users of the website into study.*

| Target Audience per Social Media in millions | Facebook | YouTube | LinkedIn | Instagram | Twitter |
|---|---|---|---|---|---|
| Customer aged 5-15 years | 2 | 8 | 0 | 3 | 0 |
| Customer aged 16-25years | 5 | 6 | 3 | 6 | 1 |
| Customer aged 26-35years | 6 | 6 | 5 | 5 | 2 |
| Customer aged 36-45 years | 5 | 5 | 3 | 4 | 2 |
| Customer aged 46-55 years | 3 | 3 | 2 | 2 | 2 |
| Customer aged above 55 years | 3 | 1 | 0 | 0 | 1 |
| Cost per thousand users(CPM) | 7.19 | 9.68 | 6.59 | 7.91 | 6.46 |

## Requirement Gathering

Optimization is directly correlated to constraints and we also had to face some while solving these models. The first constraint was regarding the budget as we didn't want PepsiCo to increase its advertising budget, although in 2019 it was increased it by 12% but this year due to COVID-19, we advised them(hypothetically) not to do it this year.

Due to rise of online streaming platforms like Netflix, Prime Video etc. a lot of people have switched over to these platforms but still we believe that relevance of cable TV have not lost completely, a constraint was decided to make spend at least 30% of the budget on advertising on television and also as lot of people are staying at home there has been a sharp increase in the television viewership. Also, the customers who have a habit of reading newspapers will continue to do so we have decided at least invest a 5% of the budget in the newspaper. The following table represents the minimum exposure company expects to get from each age category of target audience.

| Target Audience per Platform | Minimal Required Exposure in millions |
|---|---|
| Customer aged 5-15 years | 300 |
| Customer aged 16-25years | 500 |
| Customer aged 26-35years | 500 |
| Customer aged 36-45 years | 450 |
| Customer aged 46-55 years | 200 |
| Customer aged above 55 years | 100 |

For the second model where we plan to keep digital advertising budget of PepsiCo at minimum, but YouTube is a popular website and the total exposures on it are quite high, so as a constraint we plan to buy at least 6 advertisements on it. Also below are the minimum exposures that the company expects to get from each social media website based on the age of target audience.

* We have not taken exposures in 100 millions as we don't specify any budget in this case.

| Target Audience per Social media website | Minimal Required Exposure in millions |
|---|---|
| Customer aged 5-15 years | 30 |
| Customer aged 16-25years | 60 |
| Customer aged 26-35years | 60 |
| Customer aged 36-45 years | 30 |
| Customer aged 46-55 years | 20 |
| Customer aged above 55 years | 10 |

## Optimization Model

Having completed our data retrieval, we were ready to build our model. Below you will see our model's decision variables, objective function, and constraints.

## First Model:

To complete Pepsi Advertising model, we had the following decision variables:

| Definition | Decision Variables |
|---|---|
| Customers aged 5-15 years on each platform | V1 |
| Customers aged 16- 25years on each platform | V2 |
| Customers aged 26 - 35 years on each platform | V3 |
| Customers aged 36 -45 years on each platform | V4 |
| Customer aged 46-55 years on each platform | V5 |
| Customer aged above 55 years on each platform | V6 |
| | |
| Total Number of Newspaper exposures | E1 |
| Total Number of Magazine exposures | E2 |
| Total Number of Radio exposures | E3 |
| Total Number of Television exposures | E4 |
| Total Number of Outdoor exposures | E5 |
| Total Number of Internet exposures | E6 |
| Sum of all number of exposures | $E_{sum}$ |
| | |
| Number of ads purchased on Newspaper | A1 |
| Number of ads purchased on Magazine | A2 |
| Number of ads purchased on Radio | A3 |
| Number of ads purchased on Television | A4 |

| | |
|---|---|
| Number of ads purchased on Outdoor | A5 |
| Number of ads purchased on Internet | A6 |
| Total number of ads | Asum |
| | |
| Cost of Advertisement on Newspaper | C1 |
| Cost of Advertisement on Magazine | C2 |
| Cost of Advertisement on Radio | C3 |
| Cost of Advertisement on Television | C4 |
| Cost of Advertisement on Outdoor | C5 |
| Cost of Advertisement on Internet | C6 |
| Total cost of all Advertisement | $C_{sum}$ |

Our objective in this study is to maximize the total number of exposures on advertisement platform. Here is the objective function:

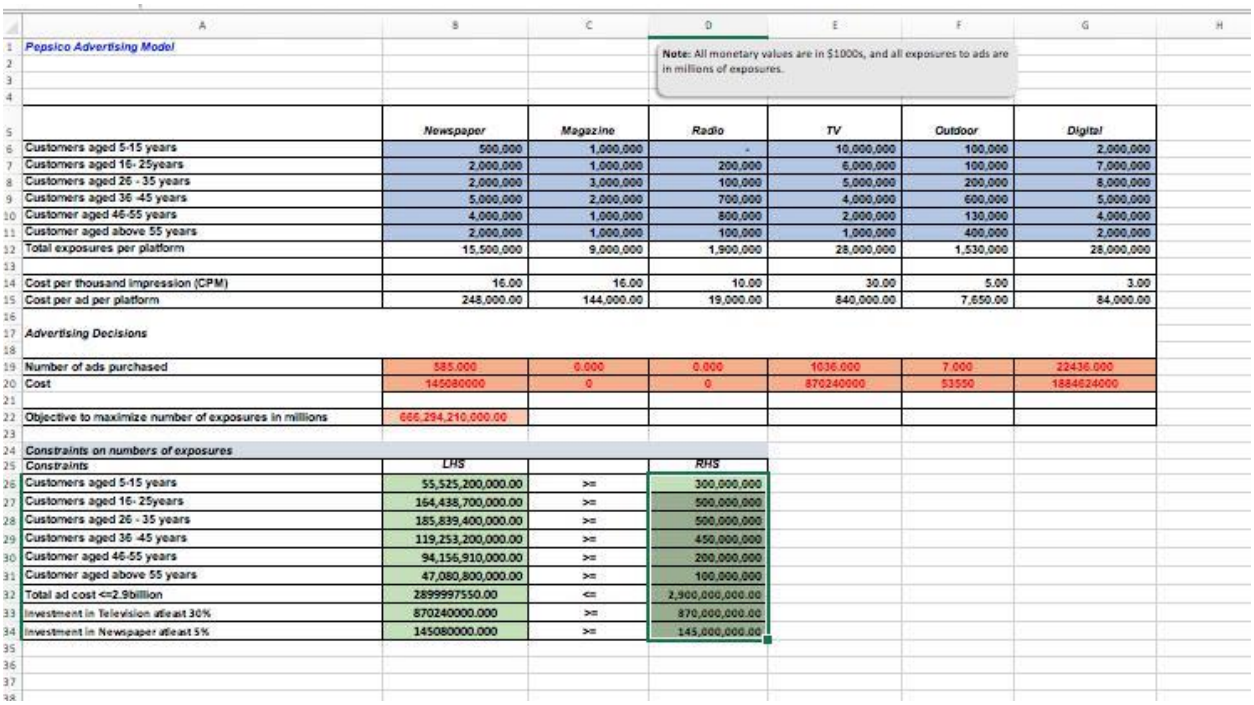
| Objective Function | Definition |
|---|---|
| Maximize total number of exposures in millions | |
| Max: E1*A1 + E2*A2 + E3*A3 + E4*A4+ E5*A5 + E6*A6 | Calculating the maximum total number of exposures by multiplying total exposures per platform and number of ads purchased per platform |

For this model, we will have the following constraints:

| **Constraints** | **Equation** | **Definition** |
|---|---|---|
| Minimum Required Exposure Customers aged 5-15 years | $V1*A_{sum} >= 300$ | Exposure for costumers aged 5-15 years should be greater than and equal to 300 million |

| | | |
|---|---|---|
| Minimum Required Exposure Customers aged 16- 25years | $V2*A_{sum}$ >= 500 | Exposure for costumers aged 16-25 years should be greater than and equal to 500 million |
| Minimum Required Exposure Customers aged 26 - 35 years | $V3*A_{sum}$ >= 500 | Exposure for costumers aged 26-35 years should be greater than and equal to 500 million |
| Minimum Required Exposure Customers aged 36 -45 years | $V4*A_{sum}$ >=450 | Exposure for costumers aged 36-45 years should be greater than and equal to 450 million |
| Minimum Required Exposure Customer aged 46-55 years | $V5*A_{sum}$ >=200 | Exposure for costumers aged 46-55 years should be greater than and equal to 200 million |
| Minimum Required Exposure Customer aged above 55 years | $V6*A_{sum}$ >=100 | Exposure for costumers aged above 55 years should be greater than and equal to 100 million |
| Total advertisement cost <=2.9billion | $C_{sum} * A_{sum}$ <= 2900000000 | Total advertisement cost is less than 2.9 billion |
| Investment in Television at least 30% | C4* A4 >= 30/100*2900000000 | 30% percent at least investment for television |
| Investment in Newspaper at least 5% | C1*A1 >= 5/100*2900000000 | 30% percent at least investment for Newspaper |
| | A1,A2,A3,A4,A5,A6 >= 0 and Integer | |

With our model constructed, we set out to solve the model with Excel's Solver. We used the Integer Linear Programming to get our optimized solution. See output below:



**Pepsico Advertising Model**

**Note:** All monetary values are in $1000s, and all exposures to ads are in millions of exposures.

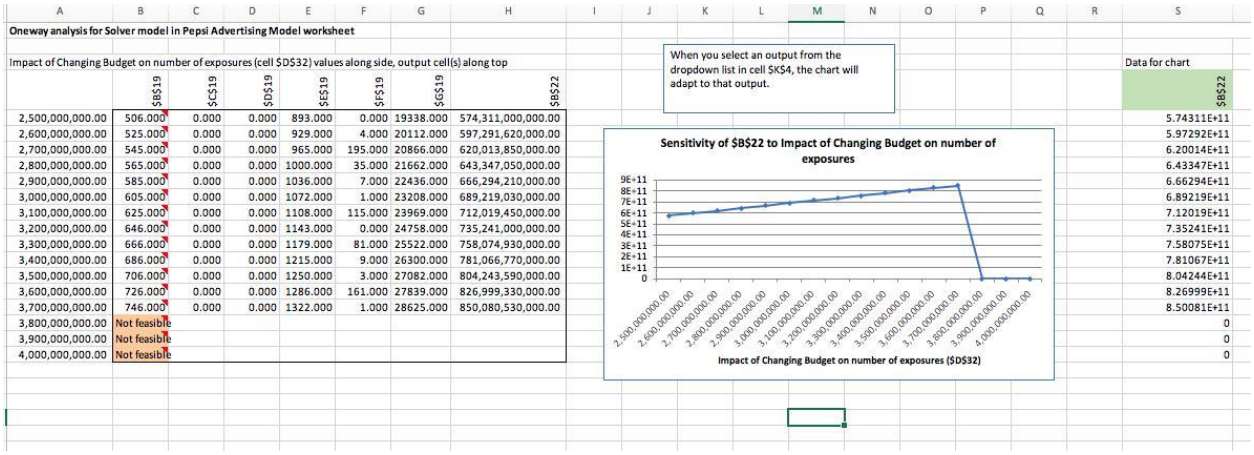
| | Newspaper | Magazine | Radio | TV | Outdoor | Digital |
|---|---|---|---|---|---|---|
| Customers aged 5-15 years | 500,000 | 1,000,000 | - | 10,000,000 | 100,000 | 2,000,000 |
| Customers aged 16- 25years | 2,000,000 | 1,000,000 | 200,000 | 6,000,000 | 100,000 | 7,000,000 |
| Customers aged 26 - 35 years | 2,000,000 | 3,000,000 | 100,000 | 5,000,000 | 200,000 | 8,000,000 |
| Customers aged 36 -45 years | 5,000,000 | 2,000,000 | 700,000 | 4,000,000 | 600,000 | 5,000,000 |
| Customer aged 46-55 years | 4,000,000 | 1,000,000 | 800,000 | 2,000,000 | 130,000 | 4,000,000 |
| Customer aged above 55 years | 2,000,000 | 1,000,000 | 100,000 | 1,000,000 | 400,000 | 2,000,000 |
| Total exposures per platform | 15,500,000 | 9,000,000 | 1,900,000 | 28,000,000 | 1,530,000 | 28,000,000 |
| | | | | | | |
| Cost per thousand impression (CPM) | 16.00 | 16.00 | 10.00 | 30.00 | 5.00 | 3.00 |
| Cost per ad per platform | 248,000.00 | 144,000.00 | 19,000.00 | 840,000.00 | 7,650.00 | 84,000.00 |
| | | | | | | |
| *Advertising Decisions* | | | | | | |
| | | | | | | |
| Number of ads purchased | 585.000 | 0.000 | 0.000 | 1036.000 | 7.000 | 22436.000 |
| Cost | 145080000 | 0 | 0 | 870240000 | 53550 | 1884624000 |
| | | | | | | |
| Objective to maximize number of exposures in millions | 666,294,210,000.00 | | | | | |

| *Constraints on numbers of exposures* | | | |
|---|---|---|---|
| Constraints | LHS | | RHS |
| Customers aged 5-15 years | 55,525,200,000.00 | >= | 300,000,000 |
| Customers aged 16- 25years | 164,438,700,000.00 | >= | 500,000,000 |
| Customers aged 26 - 35 years | 185,839,400,000.00 | >= | 500,000,000 |
| Customers aged 36 -45 years | 119,253,200,000.00 | >= | 450,000,000 |
| Customer aged 46-55 years | 94,156,910,000.00 | >= | 200,000,000 |
| Customer aged above 55 years | 47,080,800,000.00 | >= | 100,000,000 |
| Total ad cost <=2.9billion | 2899997550.00 | <= | 2,900,000,000.00 |
| Investment in Television atleast 30% | 870240000.000 | >= | 870,000,000.00 |
| Investment in Newspaper atleast 5% | 145080000.000 | >= | 145,000,000.00 |

In this model, we observe that to maximize the number of exposures, we do not need not advertise in magazines and radio, which is expected in today's digital world. The maximum advertisement is required in this order: Digital Medium > TV > Newspaper > Outdoor. This is again expected since people are connected more to the digital medium in today's age. Also, we can observe that in case of digital medium, maximum exposures is to people in age group:16-35. Similarly, for the age group: 36- 45, newspaper is the favorite option. For kids age group: 5-15, TV emerges as the favored medium. With a budget of $2.9 billion for the year of 2020, PepsiCo can approximately buy 666 billion exposures on various advertising channels. On newspaper, the company can buy 585 advertisements, 1036 on television and 22436 on digital. Total Advertisement Budget and Investment in Television and Newspaper are Binding Constraints.

# Sensitivity Analysis:

## One Way Analysis:



Oneway analysis for Solver model in Pepsi Advertising Model worksheet

Impact of Changing Budget on number of exposures (cell $D$32) values along side, output cell(s) along top

| | $B$19 | $C$19 | $D$19 | $E$19 | $F$19 | $G$19 | $B$22 |
|---|---|---|---|---|---|---|---|
| 2,500,000,000.00 | 506.000 | 0.000 | 0.000 | 893.000 | 0.000 | 19338.000 | 574,311,000,000.00 |
| 2,600,000,000.00 | 525.000 | 0.000 | 0.000 | 929.000 | 4.000 | 20112.000 | 597,291,620,000.00 |
| 2,700,000,000.00 | 545.000 | 0.000 | 0.000 | 965.000 | 195.000 | 20866.000 | 620,013,850,000.00 |
| 2,800,000,000.00 | 565.000 | 0.000 | 0.000 | 1000.000 | 35.000 | 21662.000 | 643,347,050,000.00 |
| 2,900,000,000.00 | 585.000 | 0.000 | 0.000 | 1036.000 | 7.000 | 22436.000 | 666,294,210,000.00 |
| 3,000,000,000.00 | 605.000 | 0.000 | 0.000 | 1072.000 | 1.000 | 23208.000 | 689,219,030,000.00 |
| 3,100,000,000.00 | 625.000 | 0.000 | 0.000 | 1108.000 | 115.000 | 23969.000 | 712,019,450,000.00 |
| 3,200,000,000.00 | 646.000 | 0.000 | 0.000 | 1143.000 | 0.000 | 24758.000 | 735,241,000,000.00 |
| 3,300,000,000.00 | 666.000 | 0.000 | 0.000 | 1179.000 | 81.000 | 25522.000 | 758,074,930,000.00 |
| 3,400,000,000.00 | 686.000 | 0.000 | 0.000 | 1215.000 | 9.000 | 26300.000 | 781,066,770,000.00 |
| 3,500,000,000.00 | 706.000 | 0.000 | 0.000 | 1250.000 | 3.000 | 27082.000 | 804,243,590,000.00 |
| 3,600,000,000.00 | 726.000 | 0.000 | 0.000 | 1286.000 | 161.000 | 27839.000 | 826,999,330,000.00 |
| 3,700,000,000.00 | 746.000 | 0.000 | 0.000 | 1322.000 | 1.000 | 28625.000 | 850,080,530,000.00 |
| 3,800,000,000.00 | Not feasible | | | | | | |
| 3,900,000,000.00 | Not feasible | | | | | | |
| 4,000,000,000.00 | Not feasible | | | | | | |

When you select an output from the dropdown list in cell $K$4, the chart will adapt to that output.

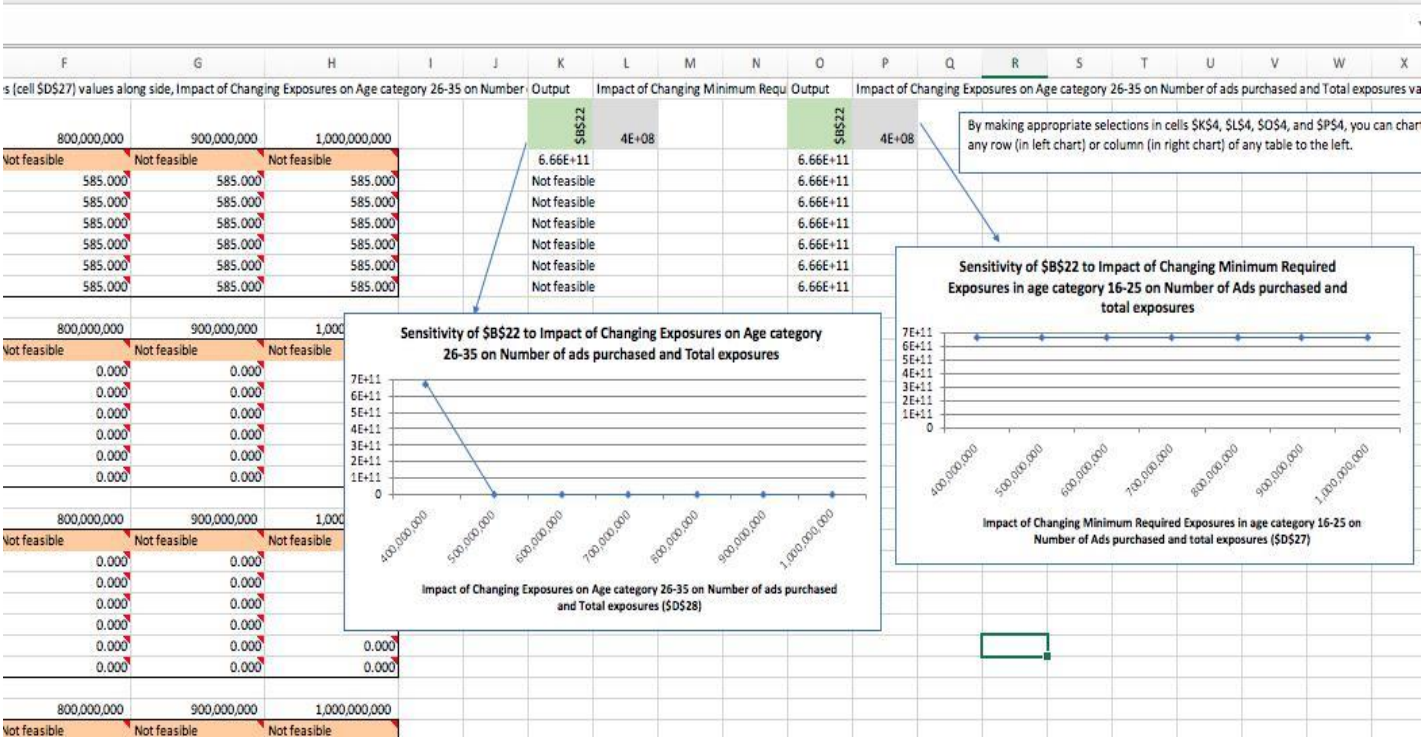
Data for chart

| $B$22 |
|---|
| 5.74311E+11 |
| 5.97292E+11 |
| 6.20014E+11 |
| 6.43347E+11 |
| 6.66294E+11 |
| 6.89219E+11 |
| 7.12019E+11 |
| 7.35241E+11 |
| 7.58075E+11 |
| 7.81067E+11 |
| 8.04244E+11 |
| 8.26999E+11 |
| 8.50081E+11 |
| 0 |
| 0 |
| 0 |



We vary the number of exposures (for each medium) versus the total advertising budget. We found that the exposures increase linearly with the increase in budget until 3.7 million dollars. This behavior is true for Digital, TV and Newspaper medium. For Outdoor there is no fixed relation between the number of exposures versus the amount spent on advertising. For radio and magazine, the exposure is zero as per our suggested model.

## Two-way Sensitivity Analysis:




We are performing two-way sensitivity analysis between the minimum exposure required versus number of ads purchased for our target age category: 16-25. We vary the number of minimum exposure required from 400 million to 1 billion and, we observe that there is no change in exposure. Hence, we can say that the minimum exposure allowable increase is 1billion and the optimal solution remains the same.

Also, for age category 26-35 which is again target age category, when we vary the minimum number exposures required from 400 million to 1 billion, we observe that such a model the number of exposures 400 million will produce some exposure but from 500 million to 1 billion, there is no feasible solution. So the minimum exposure required in this category should be 400 million.

## Second Model:

To complete Pepsi Digital Marketing model, we had the following decision variables:

| Definition | Decision Variables |
|---|---|
| Customers aged 5-15 years on each platform | V1 |
| Customers aged 16- 25years on each platform | V2 |
| Customers aged 26 - 35 years on each platform | V3 |
| Customers aged 36 -45 years on each platform | V4 |
| Customer aged 46-55 years on each platform | V5 |
| Customer aged 55 years and above on each platform | V6 |
| | |
| Cost of Advertisement on Facebook | C1 |
| Cost of Advertisement on YouTube | C2 |
| Cost of Advertisement on LinkedIn | C3 |
| Cost of Advertisement on Instagram | C4 |
| Cost of Advertisement on Twitter | C5 |
| Total cost of Advertisement | $C_{sum}$ |
| | |
| Number of ads purchased on Facebook | A1 |
| Number of ads purchased on YouTube | A2 |
| Number of ads purchased on LinkedIn | A3 |
| Number of ads purchased on Instagram | A4 |
| Number of ads purchased on Twitter | A5 |

| | |
|---|---|
| Total number of ads purchased | $A_{sum}$ |

Our objective in this study is to minimize the total digital spending although PepsiCo has a big budget. Here is the objective function.

| Objective Function | Definition |
|---|---|
| Minimize Total Digital Spending | |
| Min: C1*A1 + C2*A2 + C3*A3+ C4*A4 + C5*A5 + C6* A6 | Calculating the minimum total digital spending by multiplying cost of advertisement per platform and number of ads purchased per platform |

For this model, we will have the following constraints:

| Constraints | Equation | Definition |
|---|---|---|
| Minimum Required Exposure Customers aged 5-15 years in millions | $V1*A_{sum} >= 30$ | Exposure for costumers aged 5-15 years should be greater than and equal to 30 |
| Minimum Required Exposure Customers aged 16- 25years in millions | $V2*A_{sum} >= 50$ | Exposure for costumers aged 16-25 years should be greater than and equal to 50 |

| | | |
|---|---|---|
| Minimum Required Exposure Customers aged 26 - 35 years in millions | $V3*A_{sum} >= 50$ | Exposure for costumers aged 26-35 years should be greater than and equal to 50 |
| Minimum Required Exposure Customers aged 36 -45 years in millions | $V4*A_{sum} >= 45$ | Exposure for costumers aged 36-45 years should be greater than and equal to 45 |
| Minimum Required Exposure Customer aged 46-55 years in millions | $V5*A_{sum} >= 20$ | Exposure for costumers aged 46-55 years should be greater than and equal to 20 |
| Minimum Required Exposure Customer aged above 55 years in millions | $V6*A_{sum} >=10$ | Exposure for costumers aged above 55 years should be greater than and equal to 10 |
| Number of advertisements purchased at least 6 in YouTube | A2>=6 | |
| | A1,A2,A3,A4,A5 >= 0 and Integer | |

With our model constructed, we set out to solve the model with Excel's Solver. We used the Integer Programming on to get our optimized solution. See output below:

*Advertising Model*

**Note:** All monetary values are in $1000s, and all exposures to ads are in millions of exposures.

Inputs

| | Facebook | Youtube | LinkedIn | Instagram | Twitter |
|---|---|---|---|---|---|
| Customers aged 5-15 years | 2 | 8 | 0 | 3 | 0 |
| Customers aged 16- 25years | 5 | 6 | 3 | 6 | 1 |
| Customers aged 26 - 35 years | 6 | 6 | 5 | 5 | 2 |
| Customers aged 36 -45 years | 5 | 5 | 3 | 4 | 2 |
| Customer aged 46-55 years | 3 | 3 | 2 | 2 | 2 |
| Customer aged above 55 years | 3 | 1 | 0 | 0 | 1 |
| Total exposures | 24 | 29 | 13 | 20 | 8 |
| | | | | | |
| Cost per thousand impressions | 7.19 | 9.68 | 6.59 | 7.91 | 6.46 |
| Cost per million exposures per show | 7190.000 | 9680.000 | 6590.000 | 7910.000 | 6460.000 |
| Cost per ad per website | 172560.000 | 280720.000 | 85670.000 | 158200.000 | 51680.000 |

*Advertising Decisions*

| | | | | | |
|---|---|---|---|---|---|
| Number of ads purchased | 2.000 | 6.000 | 0.000 | 6.000 | 0.000 |

*Objective to minimize total cost* $119.92

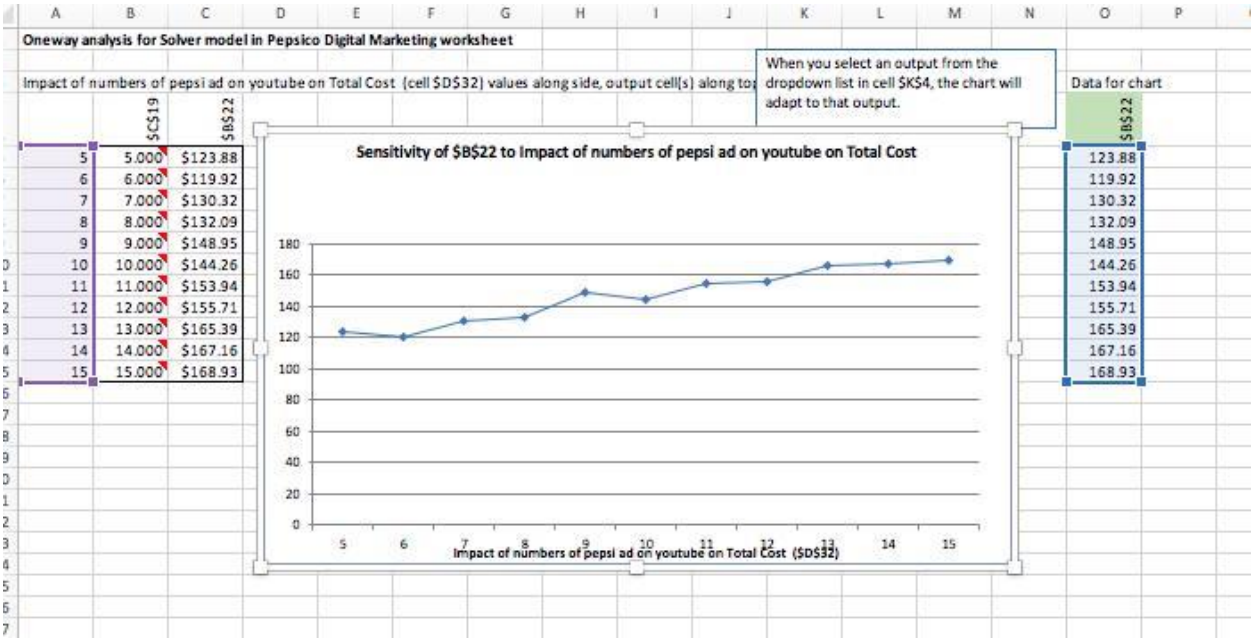
*Constraints on numbers of exposures*

| Constraints | LHS | | RHS |
|---|---|---|---|
| Customers aged 5-15 years | 70.000 | >= | 30 |
| Customers aged 16- 25years | 82.000 | >= | 60 |
| Customers aged 26 - 35 years | 78.000 | >= | 60 |
| Customers aged 36 -45 years | 64.000 | >= | 30 |
| Customer aged 46-55 years | 36.000 | >= | 20 |
| Customer aged above 55 years | 12.000 | >= | 10 |
| Number of ad purchased From youtube atleast 6 | 6.000 | >= | 6 |

Here we go deeper inside the digital medium of advertisement to find which social media platform will provide Pepsi the optimal cost per million. We observe that both Instagram and you tube emerge as the favorable mediums followed by Facebook. There is no advertising investment required in Twitter and LinkedIn as per our observations. YouTube, Instagram, Facebook are popular advertising platforms for ages: 5-15,16-25, 26-35 respectively, but to keep the total digital spending minimum, the company needs to buy 6 advertisements on Instagram, 6 advertisements on YouTube and 2 advertisements on Facebook. Number of advertisement purchased on YouTube is a binding constraint.

## Sensitivity Analysis:

### One Way Analysis:




As per the one-way sensitivity analysis between number of PepsiCo ads on YouTube versus cost per million, we observe that the optimal number of ads is 6. The cost comes out to be 119.92 dollars. If the numbers of ads is less than 6 or greater than 6, the optimal cost of advertisement will always be higher.

## Conclusion:

Doing this project as a team was a great learning experience. We got an opportunity to understand how advertising decisions are made by some big companies. While watching these ads on television we never realized that so much goes into building brand awareness. We were able to achieve our goal of getting maximum exposures on a limited budget of $2.9 billion (which is not at all small budget ) on various advertising platforms and also understand that

during pandemic like we are facing today what mediums can be best suited for companies like PepsiCo to use for advertisements of their products and digital medium was the winner.

A budget of 2.9 billion dollars allows PepsiCo to purchase 666 billion exposures, that's why while watching our favorite shows on Television or watching a video on YouTube we see so many advertisements of various companies and their products popping up. This project also helped us in building our understanding regarding the conventional such as newspaper, television etc. and modern advertising channels such as Facebook, Instagram and how advertising works on these channels, as it took a lot of research to get the cost and exposure numbers right.

Although we believe that PepsiCo has a huge advertising budget, but it is still a good practice to keep the cost of spending on digital platforms to minimum, because if the cost is minimum, the risk of incurring a loss is also minimum and Total Cost came out to be $119.32.

We were able to achieve both the goals we set with the help of Excel's amazing functionality Solver and Solver-Table. One-way and Two-way sensitivity analysis also broaden our understanding of how much we can stretch the advertising budget of PepsiCo and what will be its impact on the exposures. We also varied the minimum number of exposures but the optimal exposure remained the same. Also as YouTube is a popular medium, so we analyzed if we can increase the number of advertisements on it, how much the budget for digital advertising will increase and total budget increased with the increase in number of ads as the CPM of YouTube is very high so 6 ads was an optimal purchase.

Although we used the 2.9 billion dollars of PepsiCo advertising budget on purchasing advertisements on different mediums, but that doesn't happen originally as the company does a lot other things with this budget such as making a huge investment in events like Super Bowl where they advertise their products. But the company can still make use of our study in the field of digital advertising. This study also gave us an opportunity to learn a lot about budgeting and we hope that whatever knowledge we have gained we get to apply in the companies we work for in the future.

## References:


- Linear programming advertising model by Professor Dr. Zinovy Radovilsky
- https://adage.com/article/cmo-strategy/pepsico-trims-nonessential-advertising-and-marketing-spend-covid-19-conditions-continue/2252691
- https://www.webfx.com/how-much-does-social-media-advertising-cost.html
- https://www.lyfemarketing.com/blog/average-advertising-costs/
- https://www.marketingdive.com/news/pepsico-dive-awards/566212/
- https://digitalmarketinginstitute.com/en-us/blog/social-media-demographics-guide-for-digital-marketers
- https://www.nielsen.com/us/en/insights/article/2016/newspapers-deliver-across-the-ages/
- https://www.marketing91.com/marketing-strategy-pepsi/
- https://www.forbes.com/sites/greatspeculations/2016/03/16/how-pepsico-is-improving-its-brand-loyalty/#7a055d3e1555
- https://www.destinyjackson.org/blogs/articles-essays/brand-analysis-report-pepsi
- https://www.clickz.com/pepsico-looks-to-drive-more-personalized-experiences-via-new-foodservice-digital-lab/238801/
- https://www.referralcandy.com/blog/pepsi-marketing-strategy/

- https://www.nielsen.com/wp-content/uploads/sites/3/2019/04/nielsen-boomers-report-082912.pdf
- https://www.statista.com/