BUAN 6337.004
PROJECT REPORT
GROUP 8

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AIM:

To provide insights as a brand manager of Bugles to enhance the market share in the Corn Snacks industry.

Overview:

Different models have been used to analyze Bugles as a brand and its performance in the market. The different models in the report are:

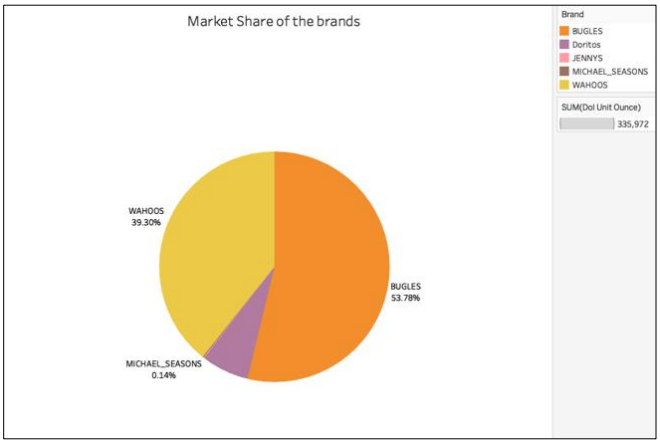
1. Exploratory Data Analysis
2. Price Elasticity
3. Customer Segmentation, Cluster Analysis & profiling using K-means
4. Product Characteristic Analysis using ANOVA

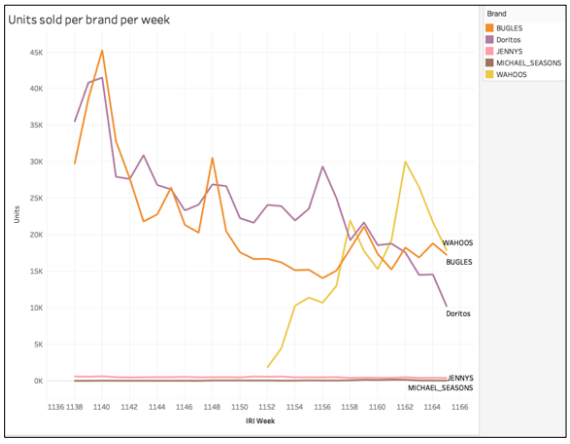
Market Share of the Brands: We combined the different brands of the bugles in our data set (Bugles, Baked Bugles, Tom Bugles) to create a whole set of Bugles.

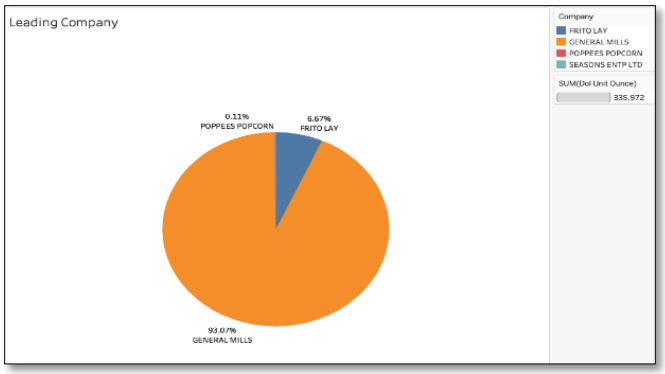
The 4 biggest competitors of Bugles are: Wahoos, Michael Seasons, Doritos & Jenny's

Exploratory Data Analysis

Brand wise Analysis

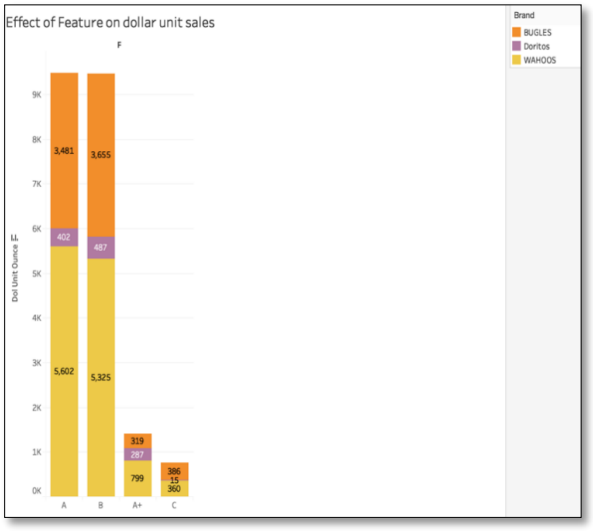


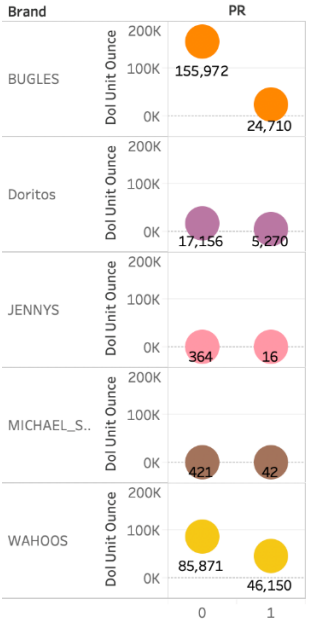




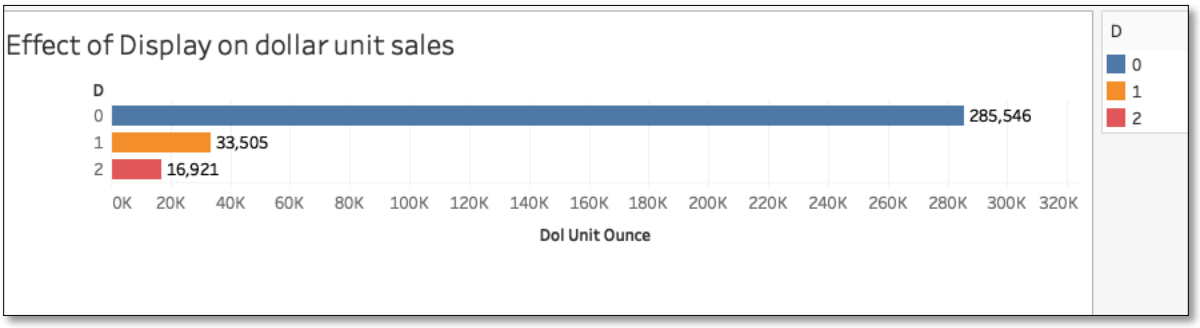
- Bugles have the highest market share amongst all the other brands in the category of Corn Snacks (No Tortilla Chips) and product Type (Corn Snacks).
- Even though, Bugles has the highest units sold per week in the initial weeks, their sales decline gradually. This could probably be because of more no of competitors entering the market in the later months/years, making most customers shift to other brands like Wahoos.
- This comes without a doubt that General Mills being one of the bigger companies in the market, is the leader in our category in terms of sales.

Customer Behavioral Analysis:





(a) **(b)**



(c)

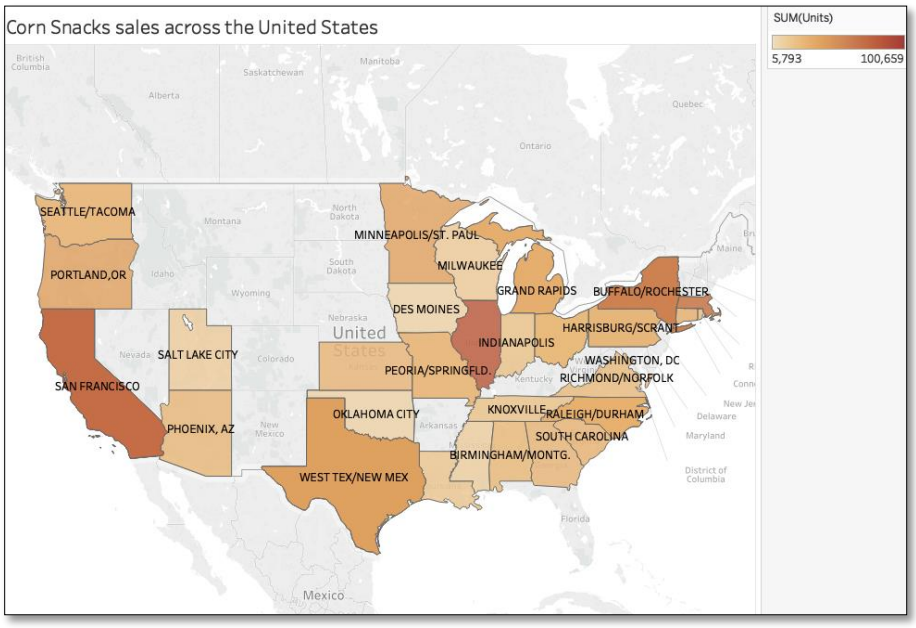
INSIGHTS:

a) Managers could make more profit by investing in medium sized ads (B) as the data shows that there's no significant difference in sales between Large size ads (A) and Medium size ads. Retailer Coupons (A+) are not available on all the brands; thus, it doesn't account for much of the sales.

b) The price reduction (1) has less effect on dollar sales compared to the ones without discount (0). This could be since only a small percentage of brands are on discounts. Most fresh arrival stocks are usually not on discount.

c) The visualization is contrary to our belief that items on major display (2) and minor display (1) are sold less than the ones with no display (0) at all. This could probably be because there are a very less percentage of items that could be showed on the display. Major fraction of the items sold are at no display.

Geo Market Distribution:



According to our data set, we see the most sales of Corn Snacks in **San Francisco** and some parts of **Indianapolis**. Other states don't really show any sales probably because of lack of data.

Price Elasticity Analysis:

OBJECTIVE: To analyze the effect of change in sales to the change in price for the brand itself (self-price elasticity) and based on the competitor's price (cross-price elasticity)

MODEL USED: PROC regression model

VARIABLES USED: Total ounces sold taken and the price for each brand which has been grouped separately alongside the interaction terms that is the weighted price of each of the brands, weighted display of brands, weighted feature of brands, weighted price reduction score of brands, interaction between price and feature, interaction between price and price reduction and the interaction between feature and price reduction.

The price per ounce is calculated as:

- Price/ounce = ((DOLLARS/UNITS)/OUNCES)

  The price per ounce is calculated as such because each of the salt snacks may vary in terms of size and hence the price per ounce is a more reliable estimate in this case.

The weighted price calculation is as follows:

- Weighted Price = Σ Price per ounce *(sales of salt snack brand/total sales of salt snack)

  Similarly, the weighted value is also calculated for the feature, display and price reduction score.

  Regression equation through SAS:

  Here Total Ounces sold:

  β0 + β1 * wt_price_brand1 + β2 * wt_price_brand2 + β3 * wt_price_brand3 + β4 * disp_wt_brand1 + β5 * disp_wt_brand2 + β6 * disp_wt_brand3 + β7 * Feature_wt_brand1 + β8 * Feature_wt_brand2 + β9 * Feature_wt_brand3 + β10 * PR_wt_brand1 + β11 * PR_wt_brand2 + β12 * PR_wt_brand3 + β13 * price_PR1 + β14 * price_PR2 + β15 * price_PR3 + β16 * price_F1 + β17 * price_F2 + β18 * price_F3 + β19 * PR_F1 + β20 * PR_F2 + β21 * PR_F3

  Where,

  Brand1 = Doritos

  Brand 2 = Wahoos

  Brand 3 = Bugles

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	1967124804	93672610	422.58	<.0001
Error	212583	47123060544	221669		
Corrected Total	212604	49090185348			

Root MSE	470.81737	R-Square	0.0401
Dependent Mean	91.01828	Adj R-Sq	0.0400
Coeff Var	517.27783		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	171.57831	1.83678	93.41	<.0001
wt_price_brand1	1	-907.74580	17.87605	-50.78	<.0001
wt_price_brand2	1	-270.45443	6.06132	-44.62	<.0001
wt_price_brand4	1	-66.03253	1.39082	-47.48	<.0001
disp_wt_brand1	1	557.63487	10.01073	55.70	<.0001
disp_wt_brand2	1	316.99196	36.33492	8.72	<.0001
disp_wt_brand4	1	81.54423	18.09823	4.51	<.0001
Feature_wt_brand1	1	265.71955	131.67841	2.02	0.0436
Feature_wt_brand2	1	-714.18658	232.26640	-3.07	0.0021
Feature_wt_brand4	1	106.45370	58.23700	1.83	0.0676
PR_wt_brand1	1	342.89283	33.25461	10.31	<.0001
PR_wt_brand2	1	426.13143	57.63286	7.39	<.0001
PR_wt_brand4	1	-290.72246	16.19282	-17.95	<.0001
price_PR1	1	-3552.97690	294.01826	-12.08	<.0001
price_PR2	1	-1091.93604	117.57975	-9.29	<.0001
price_PR4	1	72.03091	15.86395	4.54	<.0001
price_F1	1	-1677.59838	810.83184	-2.07	0.0385
price_F2	1	1125.37107	250.21459	4.50	<.0001
price_F4	1	-189.08005	29.22765	-6.47	<.0001
PR_F1	1	-235.72226	145.29604	-1.62	0.1047

To calculate Self-Price Elasticity:

Self-Price Elasticity = $\frac{\%change\ in\ Sale\ \ Brand1}{\%chang\ \ in\ Price\ Bran}$

Therefore, Self-Price Elasticity = $\frac{\triangle Sales\ Brand1}{Sales\ Bran} * \frac{Price\ Bran}{\triangle Price\ Bran}$

To calculate Cross-Price Elasticity:

Cross-Price Elasticity = $\frac{\%chang\ \ in\ Sales\ Brand1}{\%change\ in\ Price\ Bran}$

Therefore, Cross-Price Elasticity = $\frac{\triangle Sales\ Bran}{Sale\ \ Brand1} * \frac{Price\ Bran}{\triangle Price\ Brand2}$

Calculations:

Mean Total Sales		
Brand	Per Unit Price	Tot Units Price
Bugles	2.166	31.8
Doritos	0.285	177.75
Wahoos	2.78	54.09

INSIGHTS:

Here our focus is on considering **Brand 4** which is **BUGLES.**

Own-Price Elasticity Calculations for **Bugles** are follows:

Situation: When there are no feature and Price Reduction and only weighted price is available, we get = -4.49

Interpretation: When there is a reduction in price by 1% the sale of Bugles goes up by 4.49%

Situation: When only price reduction is available, we get = 4.906

Interpretation: When BUGLES reduces price by 1% and offer a discounted price then, the sales will increase by 4.9%.

Situation: When only feature is available, we get = -12.878

Interpretation: If BUGLES reduces price by 1% and adds a featured advertisement, the sales will increase by 12.878%
Situation: When Featured advertisement and price reduction both are available, we get = 21.45
Interpretation: If BUGLES reduces price and offer a discounted price alongside a featured advertisement then, the sales will increase by 21.45%.

Cross-Price Elasticity Calculations for **Bugles in comparison to Doritos** are follows:

Situation: When only Price Reduction is available, we get = 0.115
Interpretation: If Doritos brand offers discounted price implying that for every 1% decrease in Doritos price, there will be 0.115% decrease in sales of Bugles.

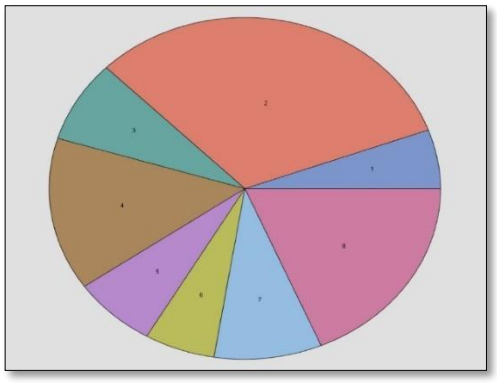
Cross-Price Elasticity Calculations for **Bugles in comparison to Wahoos** are follows:

Situation: When there is Price Reduction, we get= 3.702
Interpretation: If Wahoos brand offers discounted price implying that for every 1% decrease in Wahoos price, there will be 3.702% decrease in sales of Bugles.

K Means Clustering

We applied K means cluster on the data and here are the observations:

The entire data was divided into 8 segments.



Frequencies: _SEGMENT_

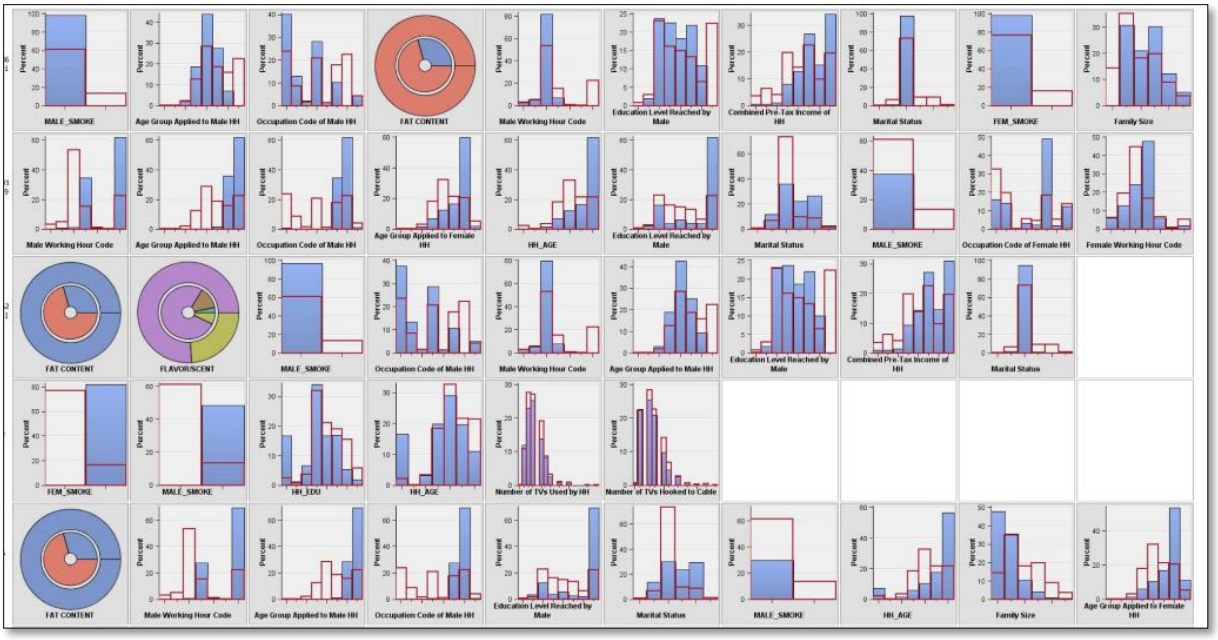
Segment Variable	Segment Value	Frequency Count	Percent of Total Frequency
SEGMENT	2	319136	31.9136
SEGMENT	8	185893	18.5893
SEGMENT	4	143062	14.3062
SEGMENT	7	88262	8.8262
SEGMENT	3	78196	7.8196
SEGMENT	5	70747	7.0747
SEGMENT	6	58200	5.8200
SEGMENT	1	56504	5.6504

Variable summary and importance of variables in the segment:

* Report Output

Variable Importance

Variable Name	Label	Number of Splitting Rules	Number of Surrogate Rules	Importance
Age_Group_Applied_to_Male_HH	Age Group Applied to Male HH	3	10	1.00000
Education_Level_Reached_by_Male	Education Level Reached by Male	0	8	0.86259
HH_AGE		2	9	0.84011
Male_Working_Hour_Code	Male Working Hour Code	4	3	0.80917
Age_Group_Applied_to_Female_HH	Age Group Applied to Female HH	3	8	0.80491
Combined_Pre_Tax_Income_of_HH	Combined Pre-Tax Income of HH	3	4	0.68182
Number_of_TVs_Used_by_HH	Number of TVs Used by HH	0	5	0.65444
FEM_SMOKE		3	1	0.61877
FAT_CONTENT	FAT CONTENT	1	0	0.58048
MALE_SMOKE		3	0	0.55119
HH_EDU		0	8	0.54166
Marital_Status	Marital Status	0	8	0.50543
Family_Size	Family Size	1	6	0.31125
Number_of_Cats	Number of Cats	0	3	0.29384
Education_Level_Reached_by_Femal	Education Level Reached by Femal	0	5	0.19984
Number_of_TVs_Hooked_to_Cable	Number of TVs Hooked to Cable	0	3	0.11007
Number_of_Dogs	Number of Dogs	0	4	0.09924



This chart shows distribution of variables and their weight of contribution in each segment.

INSIGHTS:

1. Male & Female who have planned to quit smoking have higher consumption of corn snacks as compared to non-smokers. Targeting people who have 'Higher Education Level' and have recently quit smoking would drive more sales.
2. Household with an age between 35-44 should be targeted as they're the most loyal consumer of corn Snacks. This could be because Higher Household age implies the presence of teens/children in house who consume more corn snacks.
3. Households with higher 'Education level reached by male' and with more 'pretax income' have shown a clear affinity towards Corn Snacks probably because corn snacks are popular in educated households.
4. No of TVs in a household affects the sales of Corn Snacks, hence households with TVs should be targeted more, this is because TV ads drive more sales than other methods.
5. People with dogs and cats are more likely to prefer Corn Snacks over other types

Product Characteristics Analysis by ANOVA

OBJECTIVE: In this model we try to find how the product characteristics like Flavor/Scent, Fat Content and Package influence total ounces of BUGLES brand sold.

VARIABLES USED: Flavor/scent, Package, Fat content, Cooking Method and Type of cut.

We have checked for the significance of p-value to find out if the characteristic of Bugles tempts customers to buy more.

Flavors were of the type Chili, Ques, Nacho Cheese, original and Regular 50% less fat content and regular fat content are the 2 variants more commonly purchased by the customers.

From the available packaging of Bag and Box, customers prefer bag over Boxes according to the significance levels.

The ANOVA Procedure

Class Level Information		
Class	Levels	Values
FLAVOR/SCENT	5	CHILI CON QUESO MISSING NACHO CHEESE ORIGINAL REGULAR

Number of Observations Read	83417
Number of Observations Used	83417

The ANOVA Procedure

Dependent Variable: total_ounces_sold

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	7587070.7	1896767.7	236.81	<.0001
Error	83412	668111364.9	8009.8		
Corrected Total	83416	675698435.6			

R-Square	Coeff Var	Root MSE	total_ounces_sold Mean
0.011228	281.4201	89.49735	31.80204

Source	DF	Anova SS	Mean Square	F Value	Pr > F
FLAVOR/SCENT	4	7587070.675	1896767.669	236.81	<.0001

The ANOVA Procedure

Class Level Information		
Class	Levels	Values
FAT CONTENT	2	50% LESS FAT MISSING

Number of Observations Read	83417
Number of Observations Used	83417

The ANOVA Procedure

Dependent Variable: total_ounces_sold

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1531785.4	1531785.4	189.53	<.0001
Error	83415	674166650.1	8082.1		
Corrected Total	83416	675698435.6			

R-Square	Coeff Var	Root MSE	total_ounces_sold Mean
0.002267	282.6874	89.90039	31.80204

Source	DF	Anova SS	Mean Square	F Value	Pr > F
FAT CONTENT	1	1531785.448	1531785.448	189.53	<.0001

The ANOVA Procedure

Class Level Information		
Class	Levels	Values
PACKAGE	2	BAG BOX

Number of Observations Read	83417
Number of Observations Used	83417

The ANOVA Procedure

Dependent Variable: total_ounces_sold

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	27800.6	27800.6	3.43	0.0639
Error	83415	675670635.0	8100.1		
Corrected Total	83416	675698435.6			

R-Square	Coeff Var	Root MSE	total_ounces_sold Mean
0.000041	283.0026	90.00061	31.80204

Source	DF	Anova SS	Mean Square	F Value	Pr > F
PACKAGE	1	27800.58054	27800.58054	3.43	0.0639

INSIGHTS:

- Packaging, Fat content and Flavor/Scent plays are the most crucial factors in increasing the sales of Corn Snacks.
- Cooking Method and Type of cut do not have significant effect on sales of Corn Snacks.
- Collectively, customers prefer brands with the above-mentioned characteristics over the brands that do not have them.