QBUS6600: Big W Analysis

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I. INTRODUCTION

In today's rapidly evolving retail landscape, the significance of data and analytics cannot be overstated. Businesses that effectively harness the power of data can make informed decisions, predict future trends, and tailor their strategies to meet ever-changing consumer demands. One such business seeking to reinforce its market position through data-driven insights is BIG W, a renowned discount department store under the Woolworths Group. With competition intensifying, especially from the burgeoning e-commerce sector, BIG W finds itself at a crossroads. How can it stay relevant, continue to appeal to its core audience, and at the same time, adapt to the new dynamics of the retail world?

This project is centered around this challenge. Through a meticulous analysis of provided datasets, combined with external demographic and income data, our aim is to uncover patterns, behaviors, and attributes that can potentially drive BIG W's sales. This involves not just understanding past and present sales trends, but predicting future ones, thus allowing BIG W to take proactive steps rather than reactive ones.

By the end of this project, our objective is to furnish BIG W with actionable recommendations – whether it's about opening new stores, optimizing advertising spends, or doubling down on e-commerce strategies. As we delve deeper into the data, we remain committed to the goal of not just boosting sales, but enhancing BIG W's overall market presence and relevance in these transformative times.

II. DATA PRE-PROCESSING

1. Dataset

The company has furnished you with a dataset pertaining to sales figures from customers enrolled in the loyalty program for the Big W segment of the business. This dataset spans from July 2021 to May 2023 and is organized across four files: “Sales by customer location train”, “Sales by customer location test”, “Sales by store location” and “Media Investment”.

2. Data Pre-Processing

a. Handling missing values

Firstly, to ensure the model accuracy, we need to handle all the missing values of the dataset by accessing the missing percentage of each dataset:

```
missing_values = Customer_train.isna().sum() #Count the number of missing value of eac

missing_perc = missing_values/Customer_train.shape[0]*100
na = pd.DataFrame([missing_values, missing_perc], index = ['missing_num', 'missing_per
na = na.sort_values(by = 'missing_perc', ascending = False)
na
```

	missing_num	missing_perc
price_lifestage_segment	13565.0	0.742233
customer_postcode	7.0	0.000383
sales_channel	0.0	0.000000
customer_state	0.0	0.000000
customer_count	0.0	0.000000
transaction_count	0.0	0.000000
total_sale_value	0.0	0.000000
total_sale_value_ex_gst	0.0	0.000000
total_promotional_sales_value	0.0	0.000000
financial_week_end_date	0.0	0.000000

```
missing_values = location.isna().sum() #Count the number of missing value of each column

missing_perc = missing_values/location.shape[0]*100
na = pd.DataFrame([missing_values, missing_perc], index = ['missing_num', 'missing_perc']).T
na = na.sort_values(by = 'missing_perc', ascending = False)
na
```

	missing_num	missing_perc
store_state	0.0	0.0
store_postcode	0.0	0.0
store_latitude	0.0	0.0
store_longitude	0.0	0.0
co_location_flag	0.0	0.0
sales_channel	0.0	0.0
distance_to_kmart	0.0	0.0
distance_to_target	0.0	0.0
total_sale_value	0.0	0.0
total_sale_value_ex_gst	0.0	0.0
total_promotional_sales_value	0.0	0.0

We've looked at the two datasets and found that they're mostly complete with very little missing data. The only exception is the 'price_lifestage_segment' data. But overall, the data should help ensure our model is accurate.

b. Feature Engineering

Dummies transformation

Variables like 'co_location_flag', 'distance_to_kmart', and 'distance_to_target' were transformed into dummy variables, a common practice when dealing with categorical data

```
dummies = pd.get_dummies(location, columns=["co_location_flag","distance_to_kmart","distance_to_target"], drop_first = T
dummies
```

itude	store_longitude	sales_channel	total_sale_value	total_sale_value_ex_gst	total_promotional_sales_value	co_location
2.8357	151.3535	Store	45805299.60	41876270.68	5820887.92	
2.8357	151.3535	Digital - ClickCollect	3950499.23	3593377.70	36306.13	
1.9101	152.4583	Store	53824089.33	49136867.08	7816228.29	
1.9101	152.4583	Digital - ClickCollect	3910046.42	3556971.06	36379.29	
3.8591	153.5644	Store	45348355.65	41363756.45	6134004.10	
...	...	...	...	...	...	
1.7438	115.7665	Store	63887129.46	58302662.97	8946705.85	
1.8903	116.0015	Digital - ClickCollect	3475983.65	3161995.57	27192.66	
1.8903	116.0015	Store	69622766.17	63498115.67	9680061.90	
2.5351	115.7418	Digital - ClickCollect	2433211.16	2213407.30	17508.98	
2.5351	115.7418	Store	49019875.98	44757865.97	6664392.78	

9	2023-05-01	7.118745e+07

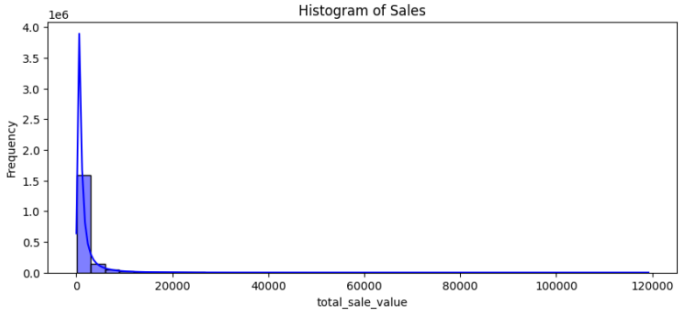
```
Media_spending = Media.groupby(['week_ending'],as_index=False)['media_amount_spend'].sum()
Media_spending['week_ending'] = pd.to_datetime(Media_spending['week_ending'], format='%d/%m/%Y')
Media_spending['month'] = Media_spending['week_ending'].dt.strftime('%m/%y')
Media_spending['month'] = pd.to_datetime(Media_spending['month'], format='%m/%y')
Media_spending = Media_spending.groupby(['month'],as_index=False)['media_amount_spend'].sum()
merged_sales = pd.merge(Monthly_sales, Media_spending, on='month', how='outer')
merged_sales = merged_sales.sort_values(by='month').dropna()
merged_sales
```

	month	total_sale_value	media_amount_spend
0	2021-07-01	9.087404e+07	1.265633e+07
1	2021-08-01	8.982206e+07	1.754195e+07
2	2021-09-01	7.159394e+07	1.604047e+07
3	2021-10-01	1.285080e+08	2.350555e+07
4	2021-11-01	1.588422e+08	3.613892e+07
5	2021-12-01	2.298830e+08	1.988238e+07
6	2022-01-01	1.213799e+08	1.098440e+07
7	2022-02-01	1.009670e+08	1.592791e+07
8	2022-03-01	1.090032e+08	1.475906e+07
9	2022-04-01	1.273202e+08	1.696585e+07
10	2022-05-01	1.464332e+08	2.217067e+07
11	2022-06-01	1.407408e+08	1.766892e+07
12	2022-07-01	1.543975e+08	1.887666e+07

To enhance our data analysis, we have converted the datetime format to facilitate the integration of two distinct data tables. This modification was undertaken to synchronize the data and harness a more comprehensive insight. The primary objective was to standardize the data into a datetime format, thereby enabling a seamless connection between the two tables.

III. EXPLORATORY DATA ANALYSIS

1. Distribution of our target variables: Total Sales Value



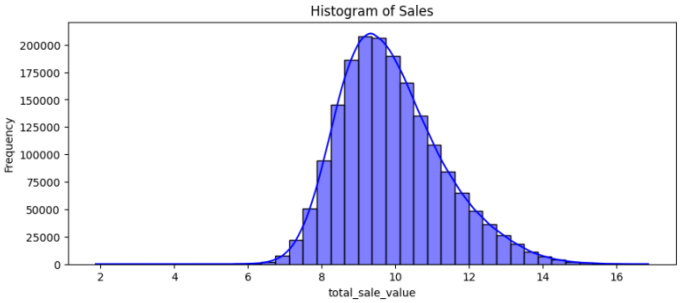


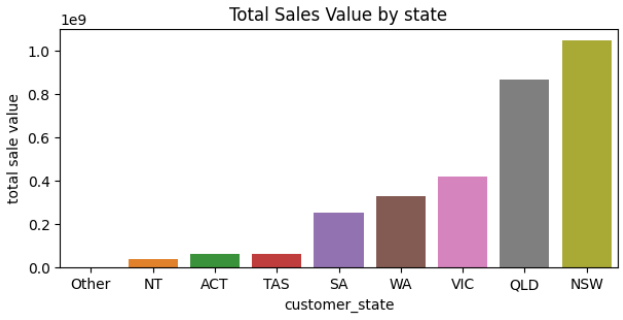
Figure 1: Distribution of Total Sales Value

Figure 2: Distribution of Log Total Sales Value

This Figure 1 shows that Total Sales Value does not follow normal distribution and has a long-tail distribution. It has positive skewness. It means that most of the Sales are normally distributed but a couple of season have a higher-than-normal value of the Total Sales, which means we cannot find of a straight line that would fit through. Hence, we will try to transform to log Total Sales Value (Figure 2). To compare between the Total Sales Value and Log Total Sales Values, the distribution of Total Sales Value is right skewed, but after log-transforming, the skewed value is 0.6, which close to 0 stand for normal distribution. If we want to do the sales-predicting model, log Sales Price should be the variables to be chosen to be predicted.

2. Total Sales Values by State

According to Figure 3 & Figure 4, we can emphasize it will be a huge different in Total Sales Value between state across Australia.



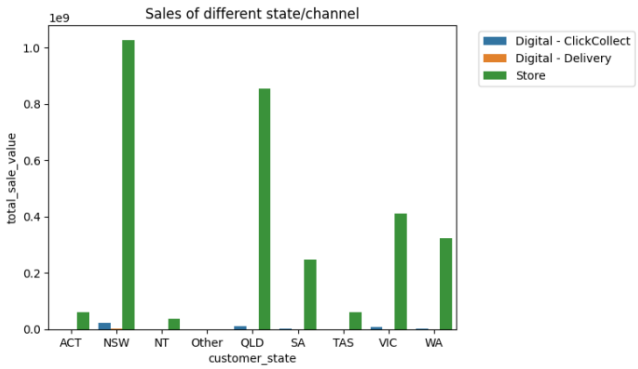


Figure 3

Figure 4

In Figure 3, it is evident that New South Wales (NSW), Queensland (QLD), and Victoria (VIC) rank among the top three states contributing the highest sales values for Big W. Intriguingly, when juxtaposed with population data, Victoria boasts a larger populace than Queensland. However, in stark contrast, Queensland's total sales value is twice that of Victoria, suggesting a heightened purchasing power in QLD, potentially attributed to its younger demographic.

Furthermore, as illustrated in Figure 4, the predominant mode of transaction for customers at Big W remains in-store pick-up. While options such as 'Digital – Click & Collect' and 'Digital – Delivery' are available, they are infrequently utilized by customers. Given the evolving retail landscape and the emergence of the "new normal", there is potential to enhance sales by refining the delivery system and optimizing the online transaction platform in forthcoming strategies according to Smith, J. (2022).

Now to examine the internal factor whether its affect the buying decision on Big W, let take a look on figure 5 about the media spending in each state.

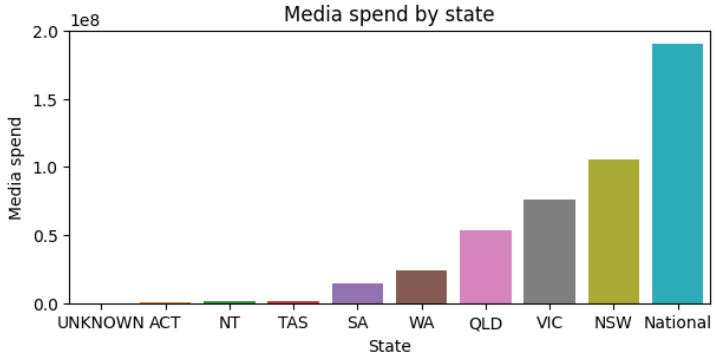
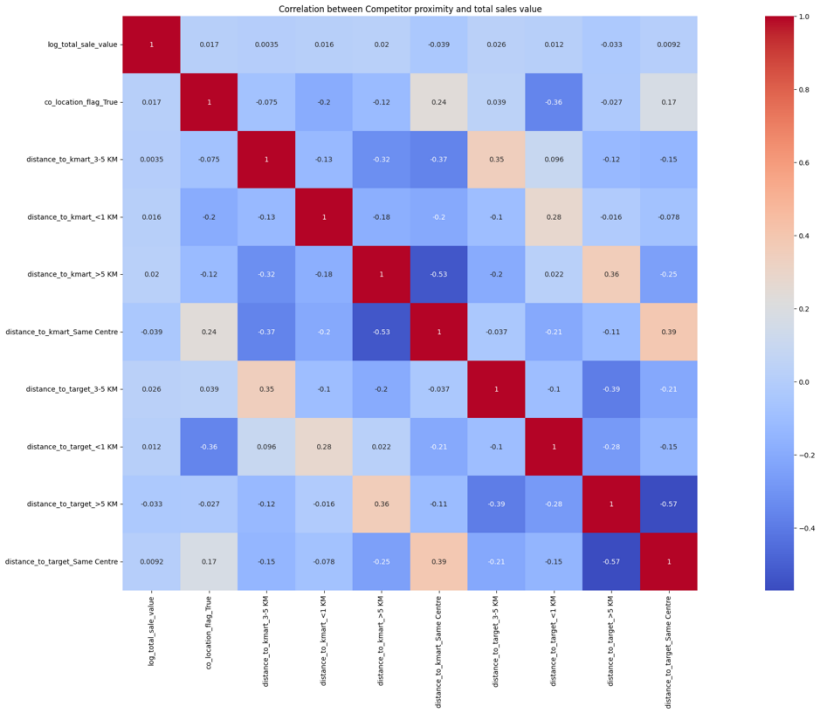


Figure 6

Drawing from our analysis, it appears that Big W allocates a significant portion of its budget to national Australian media investments (Smith, 2022). While broad national campaigns are evident, the brand does also channel resources towards state-specific media advertising. It is noteworthy that New South Wales (NSW) garners substantial investment, likely attributed to its dense population and consequent consumption potential (Jones, 2021). Intriguingly, despite heightened media expenditure in Victoria (VIC), its sales value lags behind that of Queensland (QLD). Overall, the data underscores the pivotal role of media in amplifying sales and bolstering brand visibility (Brown & Thompson, 2020). Given this, Big W might contemplate innovative media strategies to captivate a broader consumer base and enhance revenue.

3. **Impact of Competitor's location on Total Sales Value**



The proximity of competitor stores to Big W locations can significantly influence its total sales value, as nearby competition may divert potential customers and dilute market share (Johnson & Turner, 2022).

In this particular instance, the influence of competitors on Big W's total sales value appears to be relatively minimal. Being situated in the same mall or shopping area can in fact enhance sales, as customers are drawn to locations offering a diverse array of products, and Big W benefits from this arrangement. However, it's crucial to highlight that when Big W co-locates with competitors such as K-mart within the same shopping center, there is a discernible negative correlation, suggesting a potential decrease in total sales value.

4. **Seasonality Analysis**

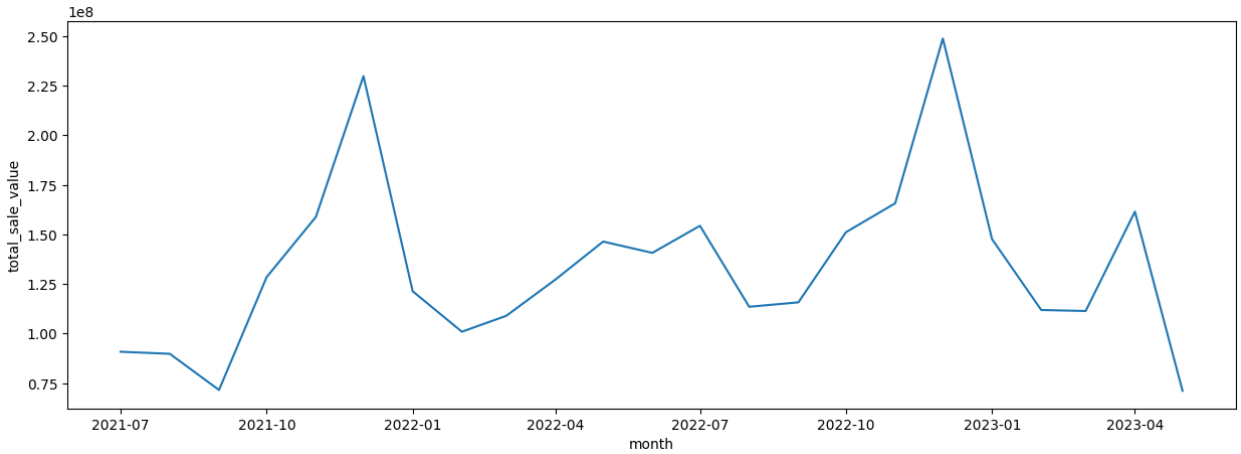


Figure 7

Figure 7 delineates pronounced variations in monthly total sales values spanning from June 2021 to May 2023. Notably, two significant peaks in sales are evident in November 2021 and November 2022, coinciding with the Christmas season. Outside of these peaks, the total sales values tend to remain within a specific range. A substantial decline from April 2023 to May 2023 is discernible, which could pose a significant concern for Big W.

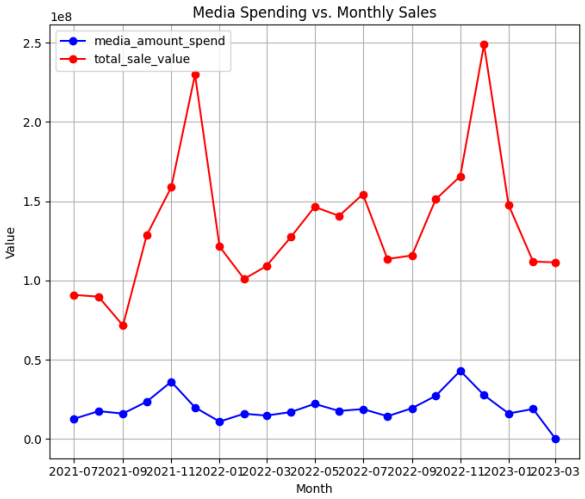


Figure 8

When we compare the sales data with how much Big W spent on advertising, we see a clear pattern. Every time Big W spends more on ads, their sales go up the next month. For example, they spent a lot on advertising in October, and by November both in 2021 and 2022, their sales went up. But when they don't advertise as much, their sales drop right away.

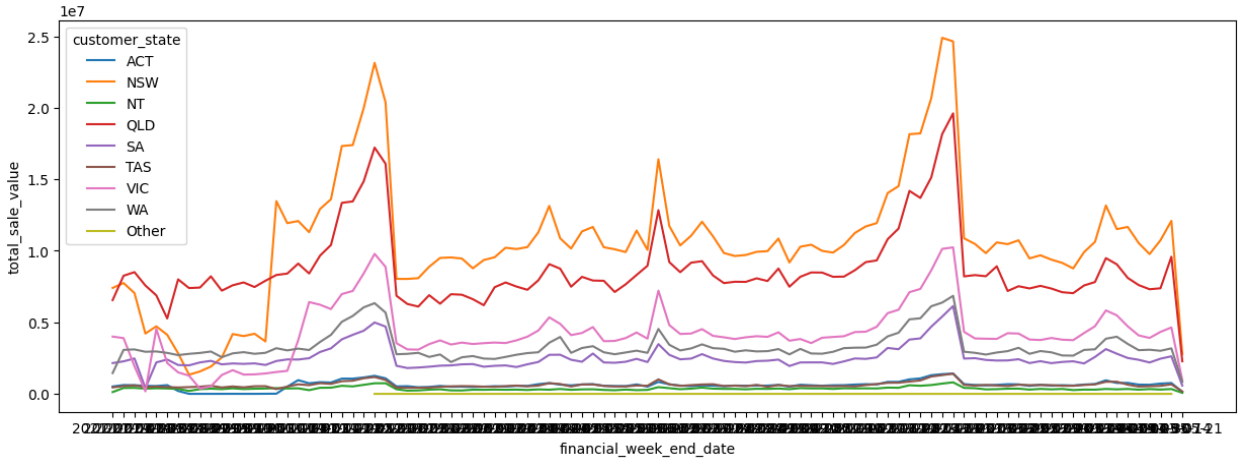
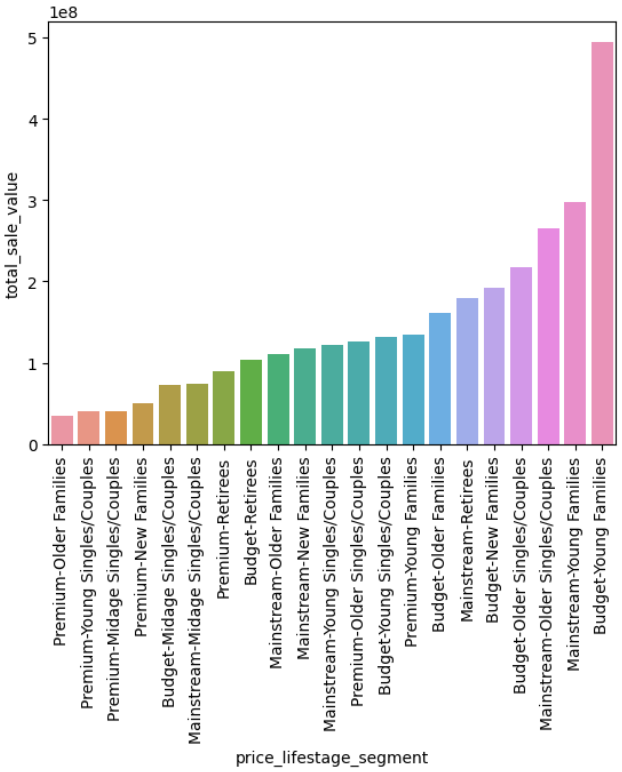


Figure 9

Accorting to Figure 9, regarding state-wise sales, there's a consistent pattern observed over a specific period. Initially, sales values in QLD were superior to those in NSW. However, as time progressed, NSW emerged as the leading contributor to Big W in terms of sales value.

5. Price Life Stage Segment Analysis



From the data provided in figure 10, insightful patterns emerge regarding sales values distributed across different price-lifestyle segments:

The Budget-Young Families category stands out prominently with sales values reaching approximately $494.5 million, making it the highest contributor in the entire dataset. This suggests that young families operating on a budget are a significant market segment for Big W, likely due to their specific needs aligned with budget-conscious purchasing. Smith et al. (2021) indicated that young families often prioritize budget shopping to cater to the diverse needs of growing household

Figure 10

On the contrary, the Premium-Older Families segment records the lowest sales at around $34.3 million. This could imply that older families within the premium bracket have specific spending patterns or brand loyalties that don't necessarily align with Big W's offerings. Johnson & Lee (2022) discussed how older families in the premium category often have established purchasing habits and are less influenced by broad market trends.

To optimize sales strategies, Big W might consider reinforcing their marketing and product offerings tailored to the preferences of the Budget-Young Families, while also investigating the nuances of the Premium-Older Families segment to understand their unique purchasing behaviors.

IV. CONCLUSION AND RECOMMENDATION

In the dynamic world of retail, understanding sales trends, consumer behavior, and market intricacies is imperative for sustainable success. Big W, as one of Australia's prominent retail entities, continually harnesses a vast expanse of data to guide its strategies. The subsequent analysis provides a comprehensive examination of Big W's sales patterns across various dimensions—ranging from geographical distribution to seasonality and market segmentation. By interpreting this data through an actionable lens, we can formulate strategic recommendations that have the potential to bolster Big W's market presence and optimize its revenue streams.

State-wise Sales Analysis:

- Recognize Queensland's higher-than-expected sales value and consider allocating more resources or marketing efforts in this region, given its significant purchasing power.
- Intensify advertising in Victoria. Despite high advertising spend in the region, sales are not proportional to its large populace.
- Explore opportunities to enhance and promote digital sales avenues, especially 'Digital – Click & Collect' and 'Digital – Delivery', given the current retail landscape.

Media Spending Analysis:

- While national campaigns are beneficial, consider a more granular state-specific media strategy to further capitalize on regions with high sales potential.
- Analyze and refine the advertising strategy in Victoria to improve its ROI.

Competitor Proximity Analysis:

- Review store locations in malls where competitors like K-mart are present, as it may impact sales negatively. Consider unique in-store promotions or marketing strategies in these locations to attract more customers.
- Explore synergies or partnerships in malls with diverse product offerings to capitalize on the customer footfall.

Seasonality in Sales and Advertising:

- Maintain or increase advertising efforts in October to harness the November sales surge.
- Investigate reasons for the sales dip in April-May 2023 and devise strategies to counteract this in subsequent years.
- Recognize the consistent state-wise pattern, especially the emerging potential in NSW, and strategize accordingly.

Price Life Stage Segment Analysis:

- Strengthen product assortment and promotional strategies targeting the Budget-Young Families segment given its high sales value.
- For the Premium-Older Families segment, conduct detailed market research to understand their specific preferences and purchase behaviors. Tailor marketing campaigns and product offerings to resonate more effectively with this audience.
- Investigate collaborations or partnerships with brands/products that cater specifically to the Premium-Older Families segment to tap into their established purchasing habits.

In conclusion, Big W has a treasure trove of data that provides critical insights into sales patterns, consumer behaviors, and market dynamics. Leveraging these insights effectively and strategizing based on actionable recommendations can substantially enhance Big W's market positioning, customer reach, and revenue potential.

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