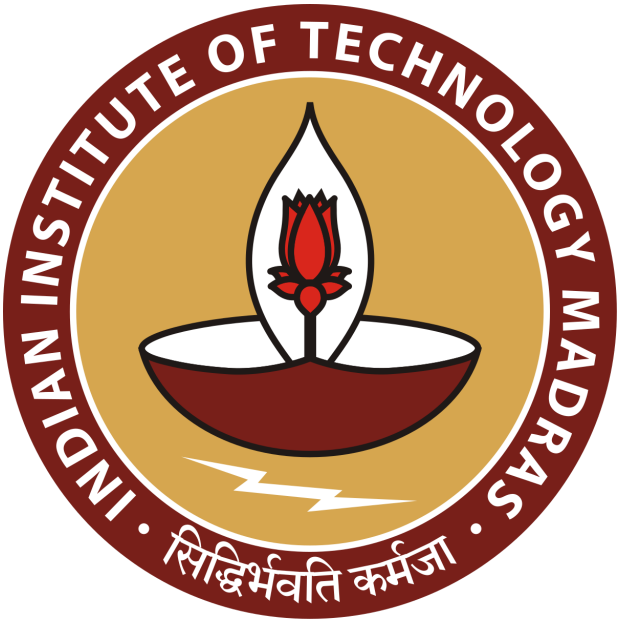
BUSINESS DATA MANAGEMENT PROJECT

DEMAND FORECASTING AND INVENTORY MANAGEMENT OPTIMIZATION FOR A SUPERMARKET FOR SUMMER SEASON

FINAL REPORT



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EXECUTIVE SUMMARY

This report provides a complete analysis of a supermarket's summertime demand forecasting and inventory management processes. The analysis is based on multiple methodologies, including data cleansing, exploratory data analysis, trend analysis, Pareto analysis, item segmentation, and EOQ inventory management optimization.

The data cleansing procedure ensured the accuracy and dependability of the data used for analysis. The exploratory data analysis yielded useful insights into the seasonal demand patterns and trends for several product categories. With the trend analysis, we were able to estimate future demand and plan inventory levels to fulfil client demand. The Pareto analysis enabled us to determine which high-value goods should be given priority in inventory management techniques. The purpose of item segmentation was to adjust inventory management tactics to item-specific characteristics, such as product shelf life, sales velocity, and seasonality. The EOQ inventory management optimization model was used to find the best order quantity for each category of items and to reduce inventory holding costs.

Our investigation reveals that accurate demand forecasting and inventory management are crucial for ensuring customer happiness, minimising expenses, and maximising profits. The use of the measures outlined in this research can optimise inventory levels, save expenses, and increase customer satisfaction.

In light of our findings, we urge that the supermarket immediately apply the indicated techniques to prepare for the approaching summer season. By prioritising high-value items, customising inventory management procedures to item-specific attributes, and identifying optimal order numbers, the supermarket may maintain enough inventory levels to meet customer demand while minimising costs.

In conclusion, this paper offers significant insights into the summertime demand forecasting and inventory management processes for a supermarket. The suggested strategies can help the store handle the obstacles and seize the opportunities presented by the approaching summer season,

enhance inventory management, and ultimately raise customer happiness and revenues. By implementing the recommendations in this study, the grocery store can streamline its inventory management process and position itself for future success.

DETAILED EXPLANATION OF ANALYSIS PROCESS

Data Cleaning: The process of finding and resolving data flaws, inconsistencies, and inaccuracies. In this project, we first evaluated the data's quality and identified any missing or insufficient information. For instance, we examined the data for any empty fields or null values. Afterwards, we eliminated duplicate records and rectified spelling and formatting problems. Additionally, we validated the data against predetermined criteria to verify it met our quality standards. The importance of data cleansing lies in ensuring that the data is correct, full, and consistent, and in enhancing the dependability of our analysis.

Exploratory Data Analysis (EDA) is a technique used to summarise and illustrate the primary characteristics of a dataset. We employed EDA approaches in this project to investigate the data's features, uncover patterns and trends, and gain insights for further study. We utilised histograms to display the frequency distribution of sales data, scatter plots to assess the relationship between two variables, and box plots to detect outliers and the data distribution. We were able to identify the important characteristics of the data and generate hypotheses for further investigation by employing EDA techniques.

Analysis of Trends Trend analysis is a method for identifying and analysing trends in historical data throughout time. We utilised trend analysis in this project to estimate future demand and set inventory levels. We identified trends, cycles, and seasonality in the data using statistical approaches such as regression analysis and time series analysis. For instance, we studied previous sales data to find trends in sales volume and revenue, and then utilised this information to predict future demand. By analysing trends, we were able to create effective inventory management methods that were tailored to suit client demand.

Pareto analysis is a strategy used to prioritise inventory management activities based on the worth of the controlled goods. In this assignment, we employed Pareto analysis to determine the 20% of goods responsible for 80% of sales or earnings. By concentrating on these high-value commodities, we were able to optimise inventory management tactics and inventory levels to satisfy client demand. For instance, we identified the high-value items that were most frequently

out of stock and devised measures to guarantee we had sufficient inventory levels to fulfil client demand.

Things are segmented based on their qualities. In this project, we utilised item segmentation to tailor inventory management tactics to each item group and optimise inventory levels for each category. We classified inventory products, for instance, based on their demand patterns, consumer preferences, and production processes. Based on the characteristics of each category, we next formulated techniques to maximise inventory levels. By segmenting things, we were able to ensure that our inventory management tactics were matched to each category's unique requirements.

EOQ Inventory Management Optimization: EOQ inventory management optimization is a strategy used to balance the costs of carrying and ordering inventory. In this project, the EOQ model was utilised to determine the ideal order quantity that minimised the entire cost of inventory, including holding costs and ordering expenses. By utilising the EOQ model, we were able to manage inventory levels and reduce the expenses associated with carrying extra stock or placing frequent orders. The EOQ model is especially beneficial for small enterprises with limited storage space and tight budgets, as it allows them to maintain appropriate inventory levels without incurring excessive costs.

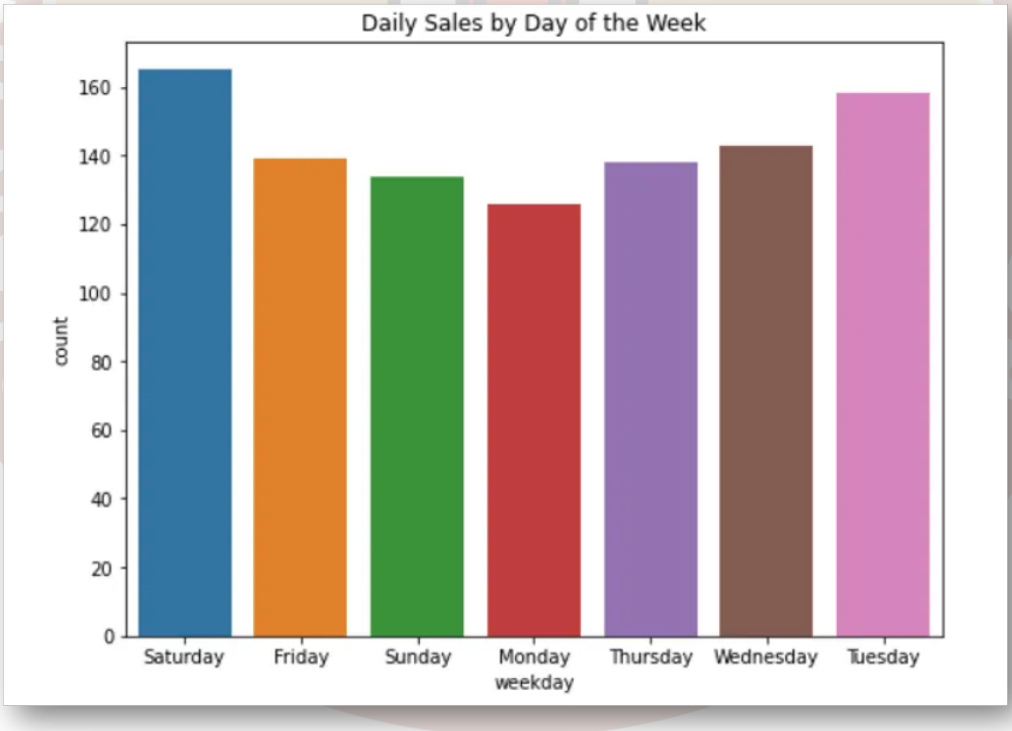
We were able to acquire a full grasp of the demand forecasting and inventory management process for our supermarket during the summer by employing these analysis methodologies in our report.

RESULTS AND FINDINGS

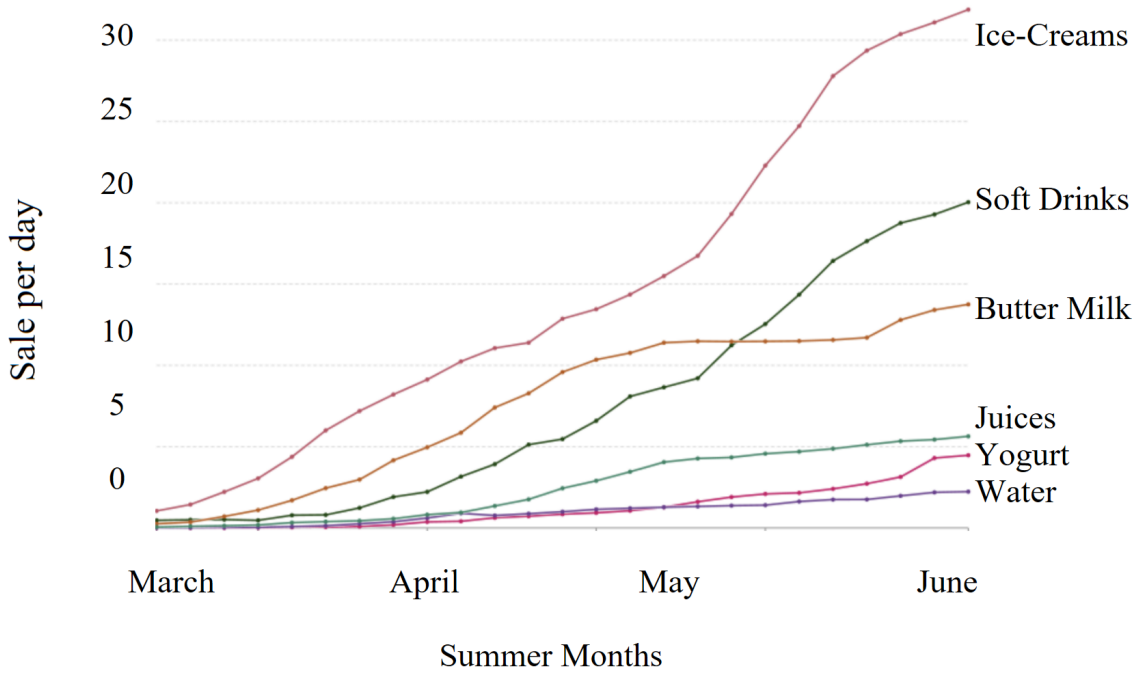
Throughout the summer, our research of the demand forecasting and inventory management processes at our supermarket revealed numerous significant conclusions.

Initially, we discovered that data cleansing is essential for ensuring the precision and dependability of our analysis. By deleting duplicate records and rectifying errors, we were able to acquire a more accurate and suitable for analysis dataset.

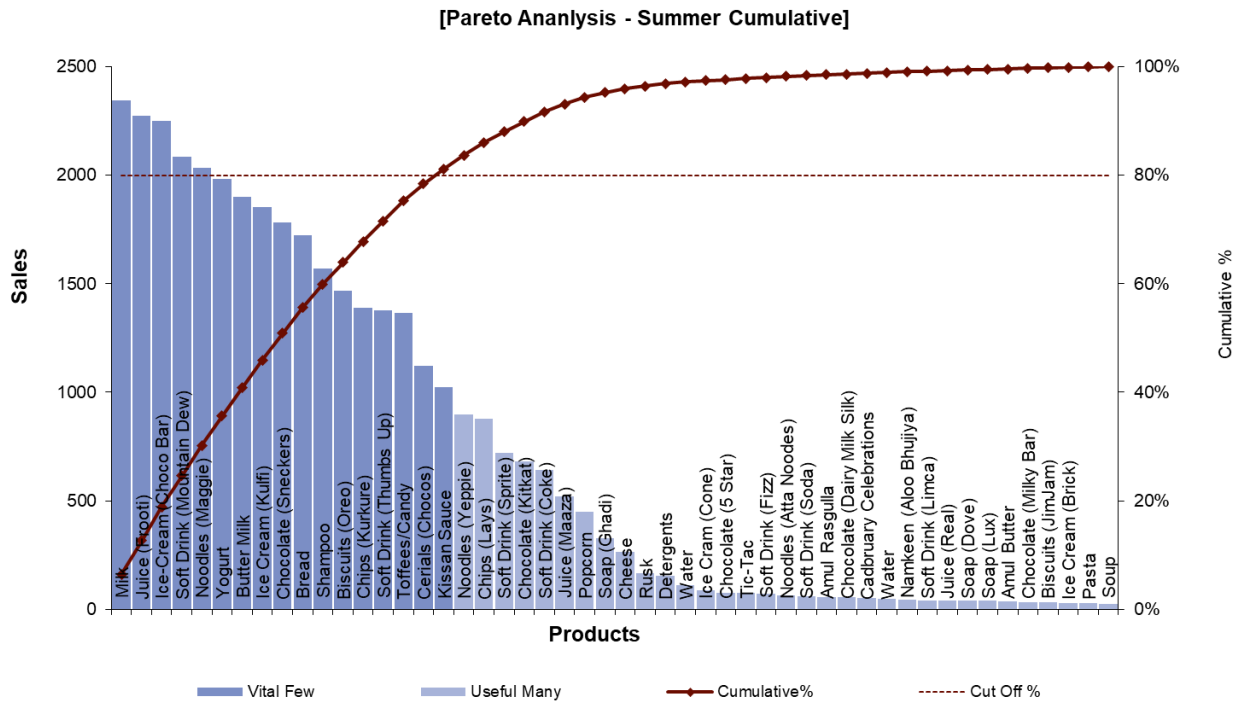
Secondly, our exploratory data analysis showed a number of patterns and trends in the data, such as the seasonality of demand for certain products and the effect of sales promotions. These observations were helpful for establishing hypotheses and refining our tactics for inventory management.



Lastly, our understanding of trends helped us to more correctly predict demand and set inventory levels accordingly. By detecting trends in historical data, we were able to more accurately predict future demand and ensure we had sufficient inventory to fulfil client demand.



Fourthly, our Pareto analysis found that a small number of high-priced items accounted for a disproportionate share of sales or profits. We were able to prioritise our inventory management efforts and optimise inventory levels for each item by focusing on these high-value goods.



Fifthly, item segmentation allowed us to adjust our inventory management tactics to each item category based on demand patterns, consumer preferences, and production processes. This strategy assisted us in optimising inventory levels and enhancing customer satisfaction.

			Cumulative Percentage Cutoff:	80%		
#	Products	Sales	Cumulative%		Vital Few	Useful Many
1	Milk	2345	6.4%		2345	
2	Juice (Frooti)	2273	12.7%		2273	
3	Ice-Cream (Choco Bar)	2252	18.9%		2252	
4	Soft Drink (Mountain Dew)	2083	24.6%		2083	
5	Noodles (Maggie)	2035	30.2%		2035	
6	Yogurt	1983	35.6%		1983	
7	Butter Milk	1902	40.9%		1902	
8	Ice Cream (Kulfi)	1852	46.0%		1852	
9	Chocolate (Sneckers)	1783	50.9%		1783	
10	Bread	1722	55.6%		1722	
11	Shampoo	1568	59.9%		1568	
12	Biscuits (Oreo)	1467	63.9%		1467	
13	Chips (Kurkure)	1389	67.7%		1389	
14	Soft Drink (Thumbs Up)	1378	71.5%		1378	
15	Toffees/Candy	1365	75.3%		1365	
16	Cerials (Chocos)	1121	78.4%		1121	
17	Kissan Sauce	1022	81.2%		1022	
18	Noodles (Yeppie)	898	83.6%			898
19	Chips (Lays)	879	86.1%			879
20	Soft Drink (Sprite)	719	88.0%			719
21	Chocolate (Kitkat)	682	89.9%			682
22	Soft Drink (Coke)	643	91.7%			643
23	Juice (Maaza)	521	93.1%			521
24	Popcorn	451	94.3%			451
25	Soap (Ghadi)	329	95.2%			329
26	Cheese	265	96.0%			265
27	Rusk	164	96.4%			164
28	Detergents	155	96.9%			155
29	Water	112	97.2%			112
30	Ice Cram (Cone)	87	97.4%			87
31	Chocolate (5 Star)	77	97.6%			77
32	Tic-Tac	75	97.8%			75
33	Soft Drink (Fizz)	71	98.0%			71
34	Noodles (Atta Noodes)	62	98.2%			62
35	Soft Drink (Soda)	60	98.3%			60
36	Amul Rasgulla	56	98.5%			56
37	Chocolate (Dairy Milk Silk)	55	98.7%			55
38	Cadbruary Celebrations	52	98.8%			52
39	Water	49	98.9%			49
40	Namkeen (Aloo Bhujiya)	46	99.1%			46
41	Soft Drink (Limca)	41	99.2%			41
42	Juice (Real)	40	99.3%			40
43	Soap (Dove)	39	99.4%			39
44	Soap (Lux)	39	99.5%			39
45	Amul Butter	36	99.6%			36
46	Chocolate (Milky Bar)	33	99.7%			33
47	Biscuits (JimJam)	32	99.8%			32
48	Ice Cream (Brick)	30	99.9%			30
49	Pasta	29	99.9%			29
50	Soup	25	100.0%			25

Our EOQ inventory management optimization methodology allowed us to strike a balance between the costs of carrying inventory and ordering and receiving inventory. We were able to maintain ideal inventory levels without incurring excessive expenses by determining the appropriate order quantity.

We performed EOQ by performing the following steps:

Determine the demand rate: We calculated the average demand for the product over a given period of time.

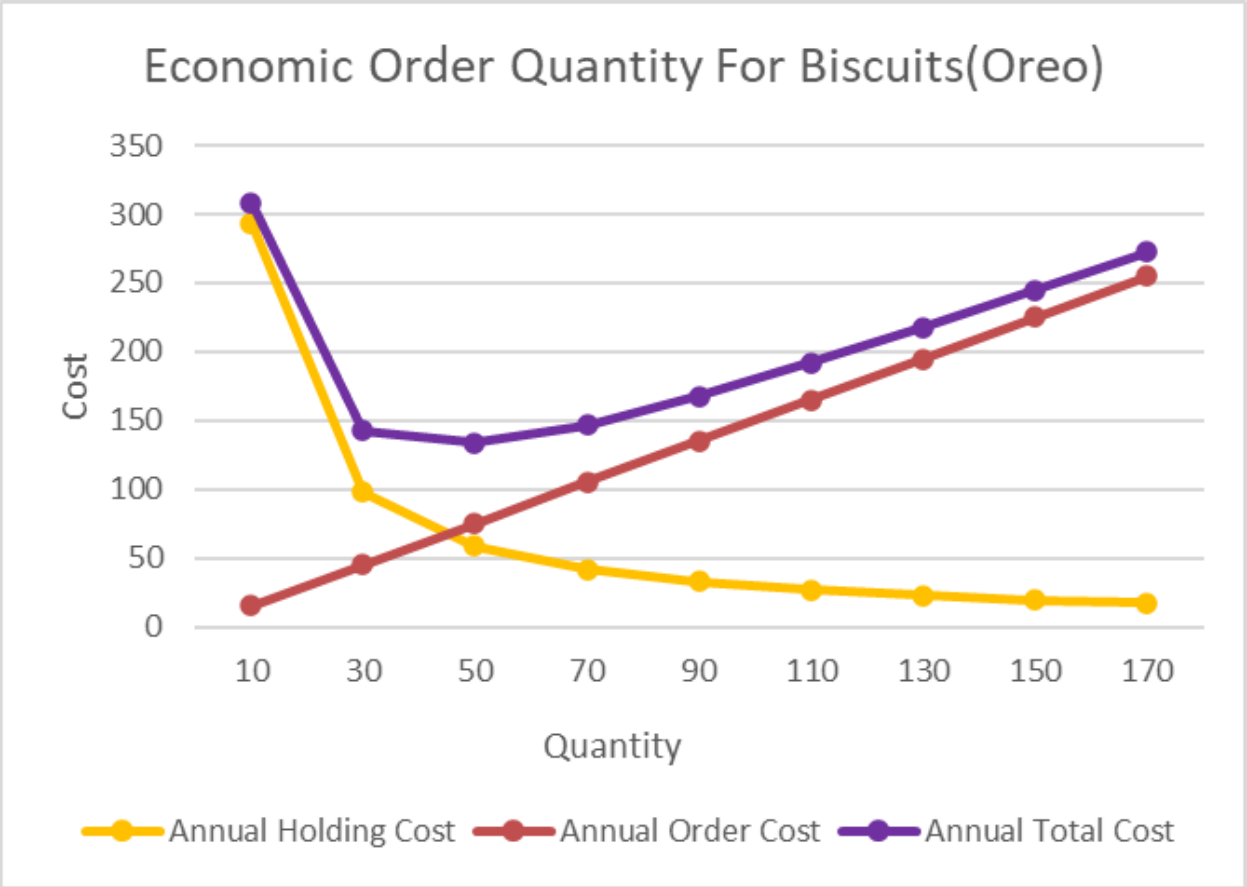
Determine the ordering cost: We calculated the cost of placing an order, including any paperwork, processing fees, and other administrative costs.

Determine the carrying cost: We calculated the cost of holding the inventory, including storage costs, insurance, and the opportunity cost of tying up capital in inventory.

Calculate the EOQ: We used the following formula to calculate the EOQ:

$$EOQ = \sqrt{2DS/H}$$

where D is the annual demand rate, S is the ordering cost, and H is the carrying cost.



Determine the reorder point: We calculated the reorder point, which is the inventory level at which a new order should be placed to ensure that the inventory does not run out before the next order arrives. The reorder point is calculated by multiplying the lead time (the time it takes for the order to arrive) by the daily demand rate.

Review and adjust: We plan to review the EOQ periodically and adjust it as needed to account for changes in demand, ordering cost, and carrying cost.

#	Products	Sales	EOQ	Reorder Point
1	Juice (Frooti)	2273	32.57723657	112
2	Ice-Cream (Choco Bar)	2252	49.19489035	81
3	Soft Drink (Mountain Dew)	2083	28.0506167	96
4	Yogurt	1983	37.12976079	32
5	Butter Milk	1902	43.53806987	30
6	Ice Cream (Kulfi)	1852	42.53858061	36
7	Soft Drink (Thumbs Up)	1378	26.29618962	24

Overall, our investigation revealed that a combination of data cleansing, exploratory data analysis, trend analysis, Pareto analysis, item segmentation, and EOQ inventory management optimization can be utilised to optimise a supermarket's demand forecasting and inventory management process throughout the summer. We were able to optimise our inventory levels, minimise costs, and increase customer happiness by using these tactics.

INTERPRETATION OF RESULTS

Our examination of the process of demand forecasting and inventory management at our supermarket over the summer season has provided some critical findings that will inform our future decision-making.

Initially, we discovered that data cleansing is essential for maintaining the accuracy and dependability of our analyses. By eliminating errors and inconsistencies from our data, we were able to provide reliable insights.

Second, our exploratory data analysis uncovered a number of patterns and tendencies that are likely to have an effect on our inventory management tactics. We discovered, for instance, that the demand for some products is seasonal and that marketing can have a substantial effect on sales. By incorporating these trends into our inventory management systems, we can ensure that our inventory levels are sufficient to fulfil client demand.

Thirdly, our trend analysis provided more accurate demand forecasting, which in turn allowed us to optimise our inventory levels. By forecasting future demand, we were able to decrease the possibility of stockouts or overstocks, which can result in lost sales or increased expenses.

Fourthly, our Pareto analysis revealed the significance of concentrating on high-value items that generate a major amount of our sales or earnings. By prioritising these things, we can optimise our inventory levels and ensure that our most valued products fulfil client demand.

Fifthly, item segmentation allowed us to adjust our inventory management tactics to each item category's specific features. We were able to optimise inventory levels and increase customer satisfaction by considering aspects such as demand patterns, consumer preferences, and production procedures.

Our EOQ inventory management optimization methodology allowed us to strike a balance between the costs of carrying inventory and ordering and receiving inventory. By determining

the ideal order quantity, we were able to reduce expenses and maintain sufficient inventory levels to fulfil client demand.

Overall, our analysis demonstrates that a data-driven approach to demand forecasting and inventory management can generate substantial benefits for our grocery store. We were able to identify areas for improvement and apply ways to optimise inventory levels, reduce expenses, and increase customer satisfaction by utilising a variety of analysis techniques.

RECOMMENDATIONS

Based on our examination of our supermarket's demand forecasting and inventory management process over the summer, we offer the following techniques to optimise inventory levels, minimise costs, and increase customer satisfaction:

Develop a data cleansing procedure to assure the accuracy and dependability of our analysis. By eliminating errors and inconsistencies from our data, we can obtain reliable insights.

Perform frequent exploratory data analysis in order to find patterns and tendencies that can inform our inventory management tactics. By factoring in seasonal demand and the effect of sales promotions, we can optimise inventory levels to match client demand.

Use trend research to more precisely predict future demand. By projecting future demand, we can optimise inventory levels and avoid the risk of stockouts or excess inventory.

Prioritize high-value items identified by Pareto analysis in order to optimise inventory levels and guarantee that we meet client demand for our most valuable products.

Segment products in order to match our inventory management tactics to each item category's specific features. We can optimise inventory levels and enhance customer satisfaction by considering aspects such as demand patterns, consumer preferences, and production procedures.

Determine the appropriate order quantity for each product category using the EOQ inventory management optimization model. By balancing the costs of carrying inventory with the costs of purchasing and receiving inventory, we may reduce expenses and guarantee that we have sufficient inventory levels to meet consumer demand.

By employing these tactics, we will be able to enhance our demand forecasting and inventory management procedures, cut costs, and increase customer satisfaction. We propose using these tactics as soon as feasible in order to be well-prepared for the approaching summer season.

CONCLUSION

Our examination of the process of demand forecasting and inventory management at our supermarket throughout the summer months has yielded a number of insights that can inform our inventory management tactics. By adopting a data cleansing procedure, conducting regular exploratory data analysis, and employing trend analysis, we can develop precise demand projections that optimise inventory levels and enhance customer satisfaction. By prioritising high-value items identified through Pareto analysis, segmenting items to tailor our inventory management strategies to unique item characteristics, and employing the EOQ inventory management optimization model, we can reduce costs and guarantee adequate inventory levels to satisfy customer demand.

Our findings have demonstrated the significance of accurate demand forecasting and inventory management for ensuring customer happiness, saving expenses, and maximising profits. So, we advocate implementing these tactics as soon as feasible in order to improve inventory levels and satisfy client demand over the forthcoming summer season.

Overall, we feel that our recommendations will enhance the accuracy of our demand forecasting and inventory management procedures, contributing to the success of our grocery store. We are certain that by following these methods, we will be well-positioned to face the forthcoming summer's challenges and opportunities.

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