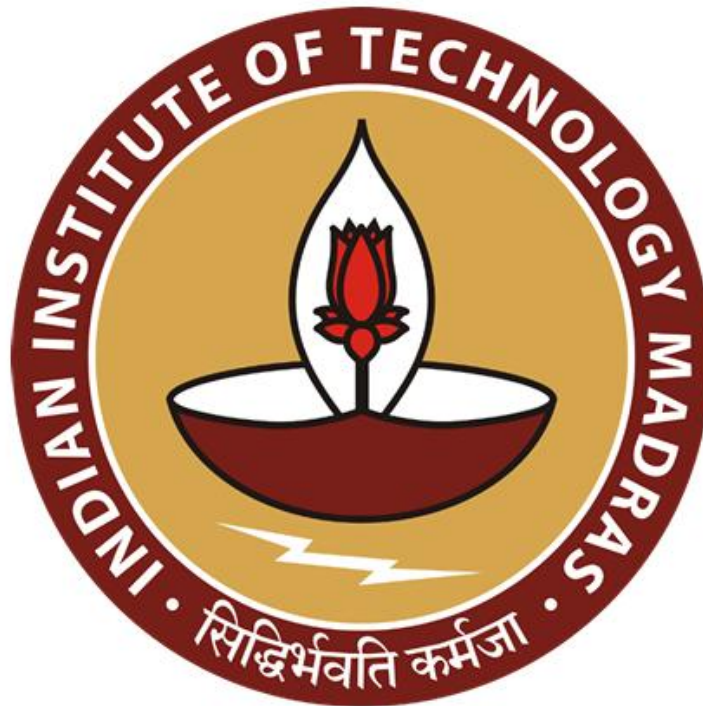# Inventory & Sales Optimization for Bakes & Cakes
Mid-Term Report for BDM Capstone Project

Submitted by

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Contents

Executive Summary:

This study is based on primary data collected from *Bakes & Cakes*, a local bakery located within the NIT Rourkela campus, owned by Mr. Sudhir Anand and operated by Mr. Sunil Anand. The shop holds a distinct advantage as the only bakery on campus, catering to a captive population of approximately 8,000 residents including students, faculty, and staff. The bakery employs Two staff members and operates daily from 8:00 AM to 9:00 PM. Offering a diverse selection of cakes, cookies, chocolates, breads, chips, and beverages, *Bakes & Cakes* generates an estimated annual profit of ₹5–6 lakhs, driven by its strategic location and steady demand.

Data collection for this study began on 3rd February, 2025 and continued for eight weeks through bi-weekly visits and on-site inventory monitoring. Manual records were digitized to facilitate analysis of sales trends, inventory turnover, and product performance across different categories: Cakes, Cookies, Chips & Chocolates, Breads, and Drinks etc.

Trend analysis revealed that whole wheat bread, dinner rolls, soft drinks, lassi, and white bread are fast-moving items, frequently restocked due to consistent demand. Cakes such as vanilla, black forest, chocolate, and fruit cakes also exhibited strong sales, especially during weekends and festive occasions.

Conversely, Red Velvet Cake, premium branded chocolates, and certain snack items showed slower turnover, remaining on shelves longer and contributing less to total revenue despite higher individual pricing. These products were identified as slow-moving, particularly when demand was inconsistent.

Profitability analysis showed that fast-moving products generally had lower margins but high sales volumes, contributing to steady cash flow. In contrast, slow-moving items had higher margins per unit, but their limited sales hindered overall profitability.

This study underscores the need for strategic inventory management, efficient shelf-space utilization, and targeted promotion of high-demand items. By refining the product mix and aligning stock with customer preferences, *Bakes & Cakes* can further reduce wastage, enhance turnover, and strengthen its financial sustainability within the NIT Rourkela ecosystem.

Proof of Originality:

Details:

- Shop Name: Bakes & Cakes
- Type of Organization: B2C (Business-to-Consumer)
- Shop's Address: Shop No.8, NIT Rourkela
- Shop Owner's Name: Mr. Sudhir Anand
- Number of Employee: 2
- Working Time: 08:00 AM to 9:00 PM (13 hours)

Image 1. Shop's Photo at Day

Image 2. Shop's Photo at Night

Proof Links:

- **Interview Video: BDM Interview**
- **Video of Shop: Shop's Video**
- **More Photographs: Shop's Photo 3**
- **More Photographs: Shop's Photo 4**
- **Authorization Letter: Authorization Letter**

Meta Data:

The sales data was gathered through manual store visits conducted every two weeks. During these visits, inventory and sales information was recorded directly on-site. To maintain accuracy and consistency, data cleaning was performed immediately, enabling real-time resolution of any discrepancies and reducing the need for later corrections. The finalized records were subsequently digitized in Excel for further analysis.

The data spans a period of 8 weeks and is organized across four biweekly sheets:

- Week 1_2

- Week 3_4

- Week 5_6

- Week 7_8

Clean Dataset Link: BDM_Project_Data

Data collection duration: 2 months

Data collection dates: 03-02-2025 to 30-03-2025

Dataset Dimensions: The dataset contains **10 columns** and **72 rows**.

Product	Category	Opening Balance		Inward Stock		Outward Stock		Closing Balance	
		Opening_Quantity	Unit_Cost	Inward_Quantity	Unit_Price	Outward_Quantity	Unit_Selling_Price	Closing_Quantity	Profit
Chocolate Cake	Cakes	4	250	19	250	19	300	4	950
Vanilla Cake	Cakes	6	220	29	220	25	250	10	750
Black Forest Cake	Cakes	5	300	22	300	17	350	10	850
Red Velvet Cake	Cakes	3	300	25	300	18	330	10	540
Fruit Cake	Cakes	4	250	16	250	17	300	3	850
Butterscotch Cake	Cakes	2	300	35	300	27	330	10	810
Strawberry Cake	Cakes	6	300	36	300	39	350	3	1950
Blueberry Cake	Cakes	4	300	54	300	48	330	10	1440
Chocolate Oreo Cake	Cakes	5	300	21	300	16	350	10	800
Choco Chips Cake	Cakes	5	300	35	300	40	350	0	2000
Cheese Cake	Cakes	5	300	39	300	33	350	11	1650
Pineapple Cake	Cakes	5	300	45	300	40	330	10	1200
White Bread	Bread	44	20	50	20	80	25	14	400
Brown Bread	Bread	72	25	50	25	82	30	40	410
Whole Wheat Bread	Bread	40	22	110	22	147	28	3	882
Multigrain Bread	Bread	20	30	92	30	96	38	16	768
Pav Bread	Bread	22	15	113	15	120	20	15	600

The table header row: Sales_Week1_Week2 (03-02-2025 to 16-02-2025)

Image: A snapshot of how the data looks like (top 20 entries)

Each sheet in the dataset documents transactions for **69 unique products**, tracking their inventory and sales activities through key operational stages:

- **Opening Balance** (Quantity, Unit Cost)

- **Inward Stock** (Quantity, Unit Price)

- **Outward Stock** (Quantity, Unit Selling Price)

- **Closing Balance** (Quantity)

- **Profit** (Calculated based on inward and outward values)

A separate sheet titled **Product_Movement_Classification** categorizes products by their movement rate to support strategic inventory decisions:

- **Fast-Moving Items:** Includes products such as Whole Wheat Bread, Pineapple Cake, and Strawberry Cake.

- **Medium-Moving Items:** It consists of items like Blueberry Cake, Vanilla cake, Bhujia and Cheese Cake.

- **Slow-Moving Items:** Encompasses Heavy Appliances, Seasonal Items, Wiring, and Structural Components.

Descriptive Statistics:

Statistic	Cakes	Bread	Tricone Ice Cream	Cups Ice Cream	Namkeen	Cookies	Drinks	Chips	Chocolates	Dry Fruits
Mean	21.44	58.54	25.07	20.3	19.23	19.75	48.25	24.7	28.4	21.65
Standard_Error	1.69	7.3	1.54	2.6	0.96	2.11	3.87	2.69	2.9	2.76
Median	18.5	54	25	18.5	20.5	16.5	39.5	23.5	31.5	17.5
Mode	17	15	20	5	22	10	38	8	10	12
Standard_Deviation	11.71	35.76	8.12	11.63	6.95	10.33	17.3	12.05	12.96	12.32
Sample_Variance	137.06	1278.78	65.99	135.27	48.26	106.72	299.25	145.17	168.04	151.82
Kurtosis	-0.46	0.52	-0.23	-1.14	-0.73	-0.69	-0.46	-0.74	-0.87	-0.33
Skewness	0.56	0.98	-0.22	0.34	0.01	0.72	0.88	0.32	0.16	0.87
Range	46	132	33	35	28	35	59	39	45	44
Minimum	2	15	8	5	7	8	29	8	10	5
Maximum	48	147	41	40	35	43	88	47	55	49
Sum	1029	1405	702	406	1000	474	965	494	568	433
Count	48	24	28	20	52	24	20	20	20	20

Image. Descriptive Statistics Summary of Sales Data across the categories.

● **Cakes:**

The average biweekly sales for Cakes are 21.44 units, with a range from 2 to 48 units, reflecting moderate variation. The standard deviation of 11.71 indicates some fluctuations in demand across the periods. A positive skewness of 0.56 suggests that while typical sales are steady, occasional spikes in demand occur, possibly around holidays. The median of 18.5 units and a mode of 17 indicate that most two-week periods see stable sales.

● **Bread:**

Bread exhibits the highest average biweekly sales at 58.54 units, with a wide range from 15 to 147 units. The standard deviation of 35.76 signals substantial fluctuations in demand. A positive skewness of 0.98 and kurtosis of 0.52 point toward occasional bulk purchases. The large variability indicates that Bread sales may be sensitive to external factors such as promotions or festive seasons.

● **Tricone Ice Cream:**

With average biweekly sales of 25.07 units and a range from 8 to 30 units, Tricone Ice Cream shows relatively stable performance. The standard deviation (8.12) is moderate, while the slightly negative skewness (-0.22) suggests occasional low-demand periods. The median (25) closely matches the mean, implying a consistent trend across most periods.

● **Cups Ice Cream:**

Cups Ice Cream averages 20.3 units per two weeks, with sales ranging from 5 to 38 units. The standard deviation of 11.63 suggests noticeable variation. A skewness of 0.3 reflects that although average sales are moderate, certain periods experience increased demand. A mode of 10 units supports the idea of frequently lower, but occasionally higher, sales spikes.

● **Namkeen:**

Biweekly sales for Namkeen average 19.23 units, with a range from 5 to 38 units. The standard deviation of 10.33 reflects modest variability, while a negative skewness of -0.73 hints at the presence of a few lower sales periods. The mode of 10 units suggests steady but relatively modest demand**.**

● **Cookies:**

Cookies demonstrate consistent biweekly sales, with a mean of 19.75 units and the lowest standard deviation (6.95) among all categories. The range (7 to 38 units) and near-zero skewness (0.01) confirm a balanced and reliable sales pattern. A median of 16.5 units and a mode of 25 indicate a stable central tendency, with limited extreme values.

● **Chocolates:**

Chocolates average 28.4 units biweekly, ranging from 8 to 47 units. The standard deviation of

12.96 and positive skewness (0.16) suggest that most periods fall within a regular sales band, with a few periods experiencing higher demand. A median of 31.5 and mode of 20 reflect typical purchase behavior with occasional peaks.

● **Drinks:**

Drinks are among the highest-selling products with a mean biweekly sale of 48.25 units, ranging from 8 to 93 units. The standard deviation of 17.3 indicates substantial fluctuations, likely tied to weather or events. A positive skewness (0.72) implies sporadic spikes in consumption, while a median of 39.5 units reflects steady baseline demand.

● **Chips:**

Chips register average biweekly sales of 24.7 units, with a range of 8 to 49 units. A standard deviation of 10.25 and a positive skewness (0.32) suggest that while most periods are consistent, some experience heightened demand. A mode of 8 hints at regularly low but occasionally increased sales.

● **Dry Fruits:**

Dry Fruits average 21.65 units biweekly, with values ranging from 5 to 40 units. The standard deviation (12.32) and positive skewness (0.87) indicate variability with occasional high-volume sales, potentially during festive seasons. The median (17.5) and mode (10) reflect that most periods involve modest but steady demand.

Methods of Analysis with Justification:

1. Data Cleaning and Consolidation

- **Process:**
  The bakery's sales data was initially maintained through handwritten records during daily operations. Over eight weeks of bi-weekly store visits, this manual data was systematically digitized into Excel format to enable comprehensive analysis. During the digitization process, several data quality issues were identified and resolved, including missing product names, inconsistent SKU nomenclature, and discrepancies in quantity measurements. The cleaned data was then organized into four bi-weekly sheets Week 1_2, Week 3_4, Week 5_6, Week 7_8, with each sheet containing 69 unique products across 10 categories. The standardized dataset tracked key operational metrics including opening/closing quantities, unit costs/prices, inward/outward stock movements, and calculated profits for each product.

- **Justification:**
  For *Bakes & Cakes*, operating as the sole bakery within the NIT Rourkela campus, accurate data cleaning is critical given the limited resources and high stakes of inventory management. Manual records are prone to human error, and inconsistent data entry could lead to poor stocking decisions, resulting in either stockouts of popular items or excessive waste of perishable goods. By digitizing and standardizing the data, Mrs. Renu Devi can make informed decisions about her daily operations, ensuring that the 69 different products across cakes, breads, beverages, and snacks are optimally managed. This systematic approach is particularly important for a small business where even minor inventory miscalculations can significantly impact the annual profit margins.

2. Descriptive Statistics Analysis:

- **Process:**
  Comprehensive statistical metrics were calculated for each product category to understand sales patterns and variability. Key metrics included mean, median, standard deviation, minimum, maximum, and total sales quantities across the 8-week period. For instance, Bread products showed the highest average bi-weekly sales at 58.54 units with substantial variability (standard deviation of 35.76, while Cookies demonstrated the most consistent performance with the lowest variability (standard deviation of 6.95. The analysis revealed that fast-moving categories like Bread and Drinks exhibited high volume but also high variability, while specialty items like Dry Fruits showed moderate volumes but commanded premium pricing.

- **Justification:**
  Descriptive statistics provide Mrs. Renu Devi with essential insights into product performance patterns crucial for a bakery serving a captive population of 6,000 residents. Understanding that Bread products have high variability helps in planning for bulk purchases during peak periods, while recognizing the consistency of Cookie sales enables steady, predictable stocking. For perishable items like cakes and breads, knowing the average demand and variability prevents both customer disappointment due to stockouts and financial losses from spoilage. This analysis is particularly valuable for the campus setting where demand patterns may fluctuate based on academic calendars, festivals, and seasonal changes affecting student and faculty consumption behaviors.

3. Product Movement Classification Analysis:

- **Process:**
  All 69 products were systematically classified into three movement categories based on their total sales volume and turnover rates over the 8-week period:

    1. **Fast Moving Items** (23 products): Including Whole Wheat Bread 347 units sold), Lassi 277 units), and Dinner Rolls 274 units), contributing to high-volume, frequent restocking requirements.
    2. **Medium Moving Items** (23 products): Such as Blueberry Cake, Vanilla Cake, and various Namkeen products, showing moderate but steady demand patterns.

    3. **Slow Moving Item**s (23 products): Including premium items like Red Velvet Cake, specialty chocolates, and certain dry fruits, characterized by lower turnover but higher profit margins per unit

- **Justification:**
  This classification system enables Mrs. Renu Devi to implement differentiated inventory management strategies appropriate for her diverse product portfolio. Fast-moving items like staple breads and popular beverages require frequent monitoring and bulk purchasing to prevent stockouts, especially crucial given the bakery's monopoly position on campus. Medium moving products can be managed with standard reorder cycles, while slow-moving premium items can be stocked in smaller quantities to minimize working capital requirements and reduce spoilage risk. This approach is particularly important for *Bakes & Cakes* as it allows optimal allocation of limited shelf space and storage capacity while ensuring that high-demand items always remain available for the campus community.

4. Trend Analysis

- **Process:**
  Sales performance over the 8-week period was evaluated to detect recurring patterns such as weekday vs. weekend trends, and seasonal or event-based spikes. Products like vanilla and fruit cakes showed noticeable upticks during weekends and festive periods. Similarly, sales of drinks and chocolates increased during warmer weather and examination periods.

- **Justification:**
  Recognizing these temporal patterns equips *Bakes & Cakes* with the ability to forecast demand peaks and valleys. For example, increased weekend footfall can justify restocking fast-moving items like cakes and soft drinks before Saturdays. Trend insights enable preemptive planning for high-demand intervals, ensuring customer satisfaction and minimizing lost sales.

Results and Findings:

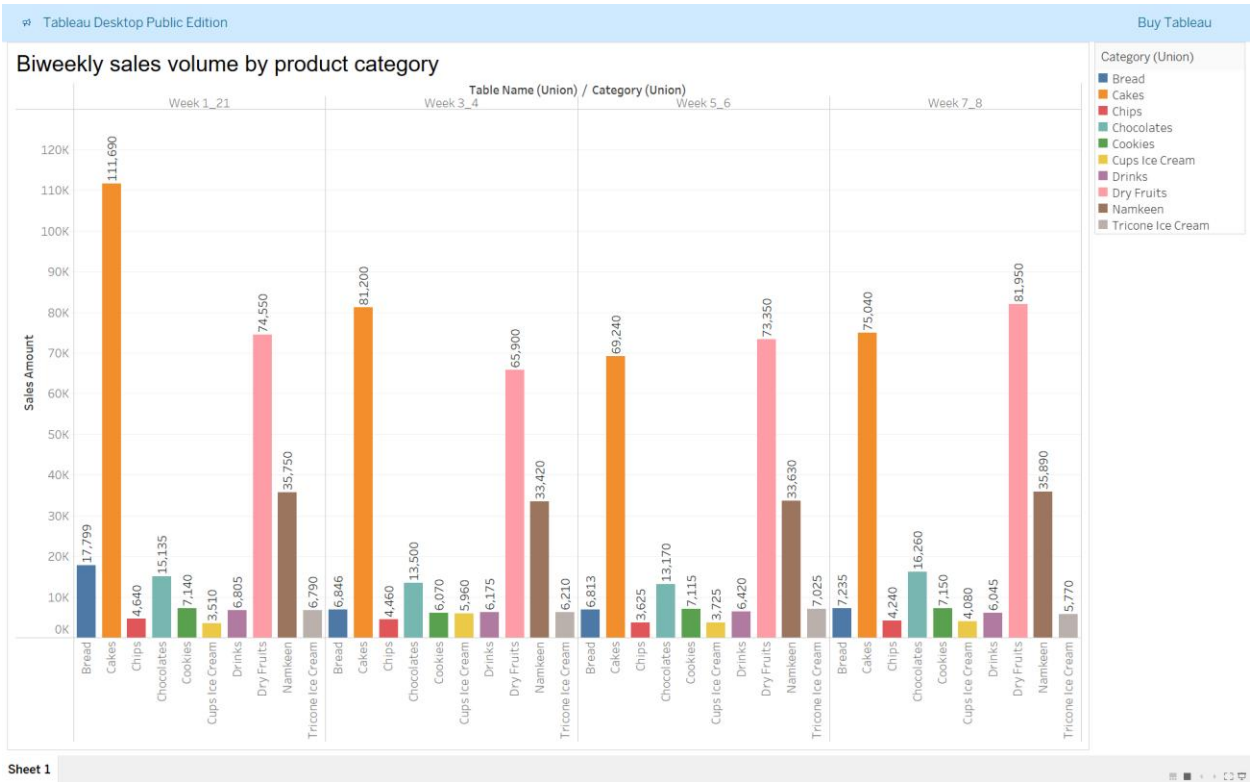**1.Biweekly Sales Volume by Product Category:**

Image 3. Biweekly Sales Volume by Product Category

The chart above shows biweekly sales volumes for each of the product categories over the 8-week analysis period. The following patterns were observed:

- Cakes consistently achieved the highest sales volumes across all periods, indicating their role as a core, high-demand item in the product portfolio.

- Dry Fruits also maintained strong performance, ranking second in sales for each biweekly period. This suggests steady demand and likely frequent restocking needs.

- Namkeen, Bread and Chocolates showed moderate sales volumes with some variability, indicating they cater to periodic demand—perhaps driven by seasonal preferences or specific consumer needs.

- Drinks, Chips, Cookies, and Ice Creams had lower but steady sales, suggesting a smaller but consistent customer base.

- Notably, the data shows that Cakes and Dry Fruits form the backbone of the sales, while other items contribute to a more diverse but stable demand.

These insights help differentiate between core inventory items and variable sellers:

- Core sellers (like Cakes and Dry fruits) need continuous inventory replenishment to avoid stockouts.

- Variable items (like Ice Creams and Drinks) may be more sensitive to seasonal demand spikes or special promotions.

Understanding these patterns helps inform effective inventory planning, prevent overstocking or shortages, and align procurement with actual customer demand cycles.
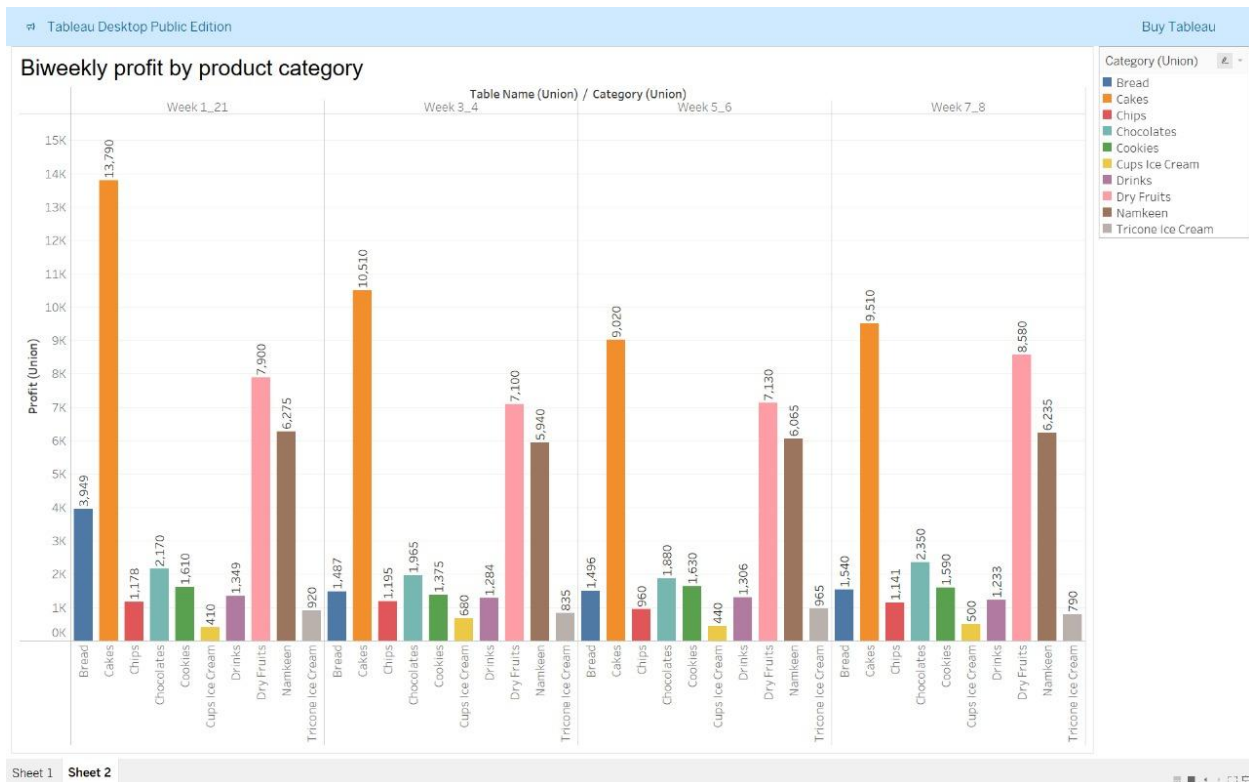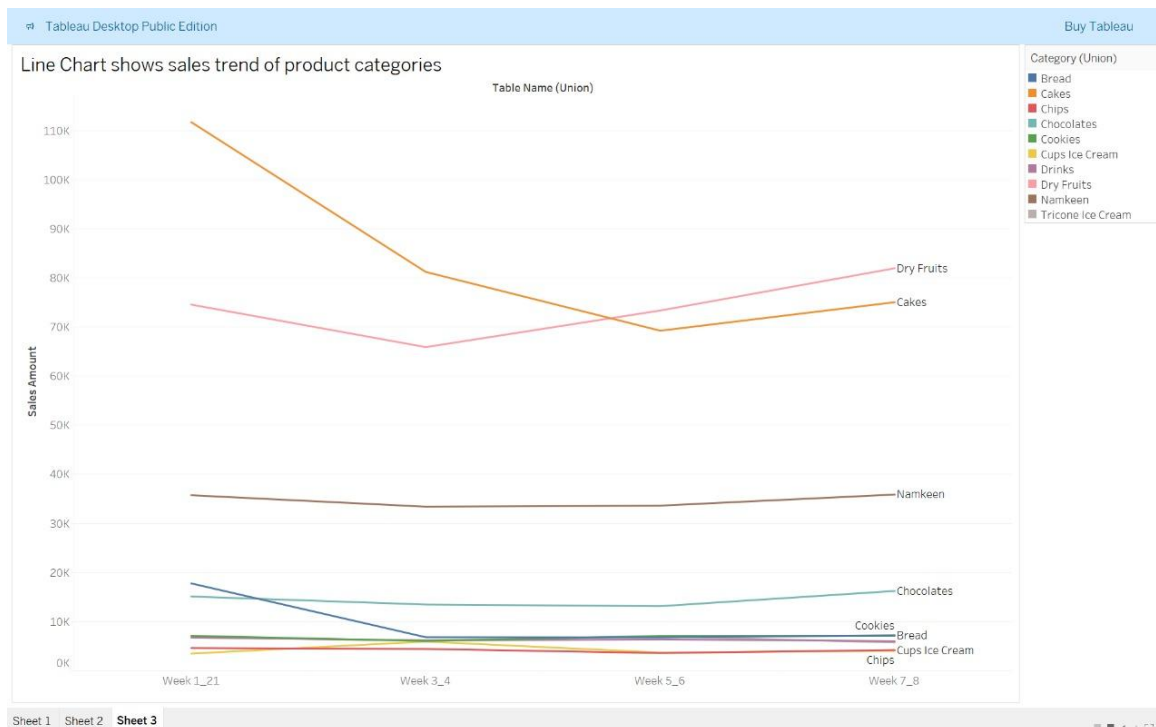
2. Biweekly Profit by Product Category:

Image 4. Biweekly Profit by Product Category

- Cakes consistently generated the highest profit across all periods, indicating robust and sustained demand for this staple product.

- Dry Fruits consistently delivered the second highest profits, highlighting their importance as a popular and high-margin category.

- Bread and Namkeen, while contributing moderate profits, showed a steady performance but did not match the levels of Cakes or Dry Fruits.

- Cakes and Chips maintained moderate profits throughout, underscoring their role as reliable, moderately priced items that complement top categories.

- Chocolates, Cookies, and Namkeen displayed consistent but lower profits, suggesting their contribution as supporting revenue drivers.

- Ice Cream consistently showed the lowest profits across all biweekly periods, signaling an area that may need attention or repositioning in future business strategies.

These insights can help prioritize purchasing, marketing, and inventory decisions by focusing not just on sales volume, but on profitability, ultimately guiding better strategic choices.

3.Biweekly Sales Trend by Product Category:

Image

5. Biweekly Sales Trend by Product Category

This line chart presents the sales trend of various product categories over four biweekly periods labeled as Week 1_2, Week 3_4, Week 5_6, and Week 7_8.

The vertical axis represents the Sales Amount, while the horizontal axis shows the biweekly time periods. Each line corresponds to a different product category, indicated in the color-coded legend on the right.

- Dry Fruits and Cakes dominate the sales figures, with Dry Fruits showing a rising trend from Week 3_4 to Week 7_8.

- Cakes initially decline in sales but then recover toward the end.

- Namkeen maintains a relatively steady sales pattern with a slight upward trend.

- Chocolates and Cookies show moderate but stable sales.

- Bread, Chips, Cups Ice Cream, and Tricone Ice Cream are in the lower sales range with minimal fluctuations.

This chart helps identify seasonal patterns, top-selling categories, and potential areas for marketing focus or inventory adjustments over time.

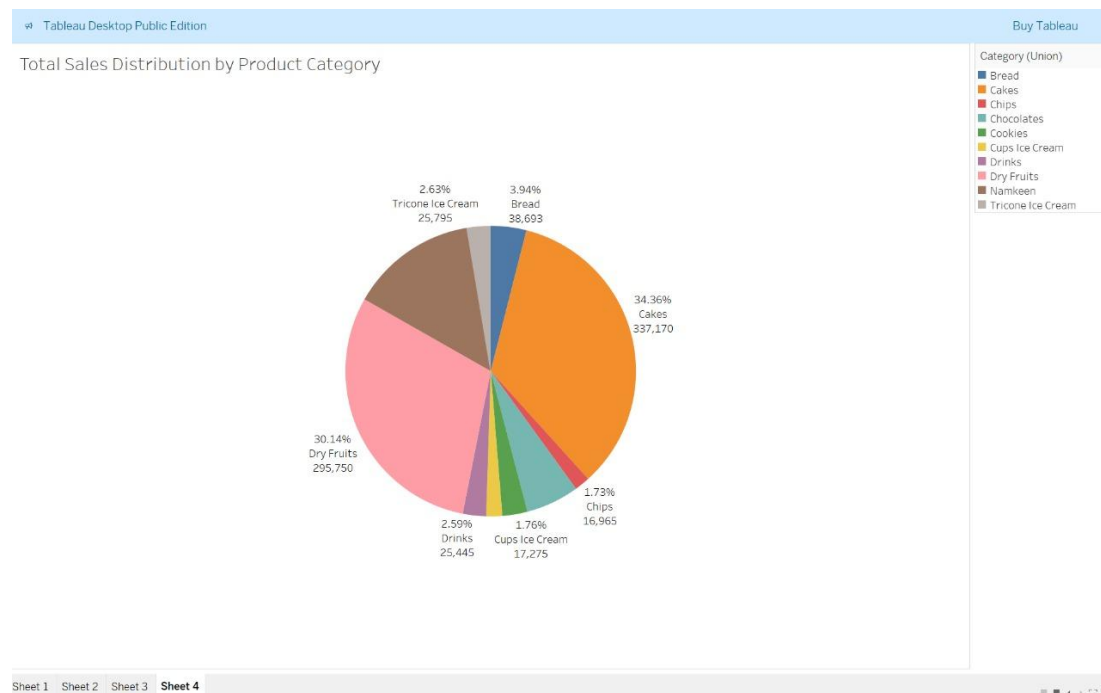## 4.Total Sales Distribution by Product Category:

Image 6. Total Sales Distribution by Product Category

- Cakes leads the sales with the largest share of 34.36%, totaling ₹337,170.

- Dry Fruits follow closely with 30.14% share and ₹295,750 in sales.

- Namkeen contributes a notable portion (exact % not shown in the image but visually significant).

- Bread accounts for 3.94% (₹38,693), while Tricone Ice Cream, Drinks, Cups Ice Cream, and Chips hold smaller shares, each under 3%.

- Categories like Chocolates, Cookies, and Chips represent minor portions of the total sales pie, indicating lower overall demand or sales volume.

This chart gives a clear snapshot of which products drive the highest revenue, aiding in business decisions such as inventory prioritization, promotional planning, or product discontinuation.
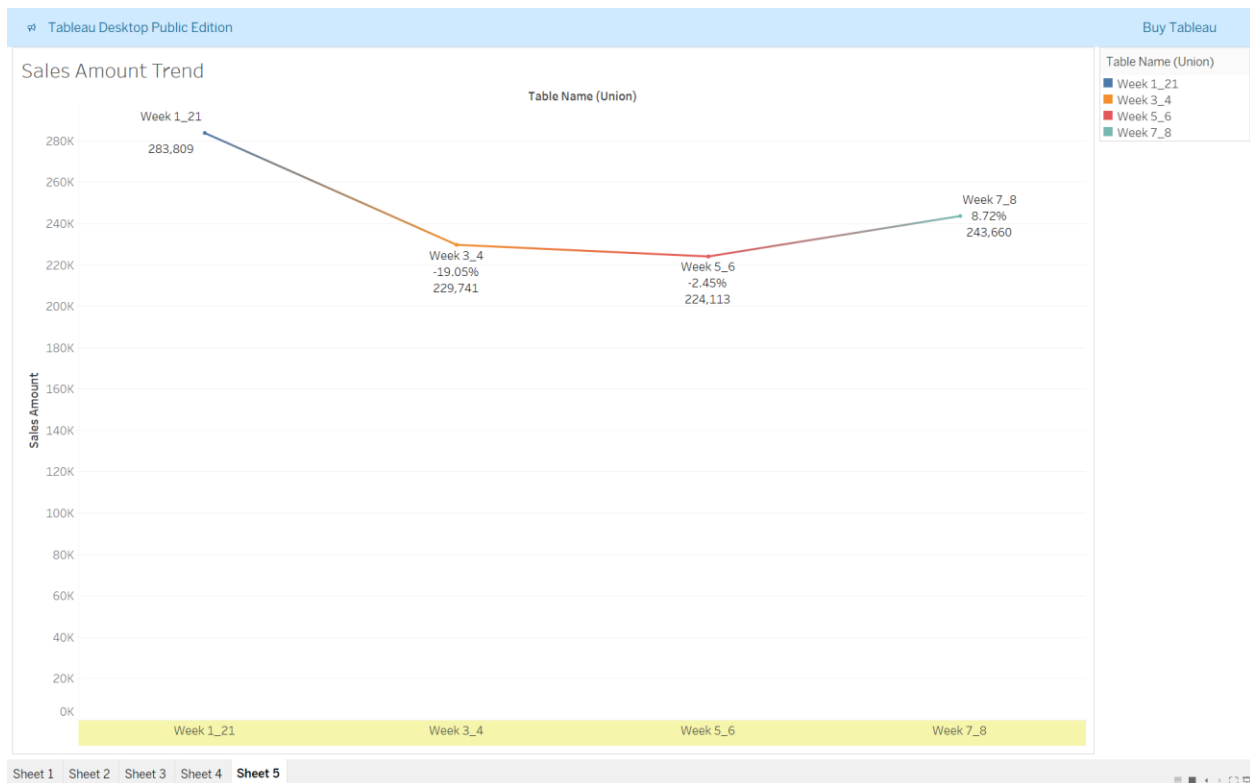
5.Biweekly Sales Amount trend:

Image 7. Biweekly Sales Amount Trend

- Week 1_2:
  Sales started strong at ₹283,809, representing the peak performance period in the dataset.

- Week 3_4:
  Sales dropped significantly by 19.05%, bringing the total down to ₹229,741. This indicates a major dip, possibly due to seasonal variation, supply issues, or reduced demand.

- Week 5_6:
  A further but smaller decline occurred with a 2.45% drop in sales, reaching a low of ₹224,113. This period marks the lowest total sales and could be a red flag for the business.

- Week 7_8:
  The trend reversed, showing a recovery of 8.72% as sales rose to ₹243,660. This upswing might reflect improved marketing, product availability, or increased customer demand.

Insights:

- The visual trend shows an initial decline in total sales followed by a modest recovery.

- The percentage changes between periods help quantify performance shifts and identify critical points for analysis.

- This type of chart is ideal for monitoring overall business performance, helping decision-makers understand when and where interventions may be needed.