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| Business Report |
| By Anjali Sharma  University of Arkansas at Little Rock  December, 2024 |

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| ExeCutive Summary |
| Adventure Works, a prominent bicycle manufacturing company, is facing profitability challenges across its product lines, customer segments, and operational practices. Despite its strong market presence, the company struggles to balance high production volumes with sustainable margins. The business analysis conducted aimed at uncovering the root causes of these issues and providing actionable insights to improve profitability. By leveraging sales, production, and financial data, the analysis evaluated key metrics, including sales performance, cost efficiency, and discount strategies, highlighting areas that are negatively impacting the company’s bottom line.  The analysis revealed substantial variations in profitability across product categories, models, and customer segments. Retail sales were found to be more profitable than wholesale, but some product lines with high production volumes failed to generate expected profits due to excessive discounts and lower demand. Certain subcategories, such as high-cost components or low-volume products, also emerged as major contributors to declining margins. Additionally, operational inefficiencies in production and supply chain management, combined with inconsistent discounting practices, were identified as critical areas affecting profitability.  To address these challenges, several strategic recommendations were developed. First, optimize pricing strategies by focusing on high-margin, high-volume products while reducing discounts on low-performing lines. Second, streamline production and supply chain processes to reduce costs and improve efficiency. Third, evaluate and discontinue unprofitable product lines while reallocating resources to high-demand models and innovation. Lastly, leverage advanced analytics and data visualization tools to monitor sales performance, profitability trends, and operational efficiency continuously. Implementing these strategies will enable Adventure Works to achieve sustainable profitability and strengthen its competitive edge in the market. |

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| business Analysis |
| Company Overview Adventure Works Cycles is a multinational bicycle manufacturing company headquartered in Bothell, Washington. It specializes in producing and distributing metal and composite bicycles across commercial markets in North America, Europe, and Asia.  In recent years, Adventure Works Cycles acquired Importadores Neptuno, a small manufacturing plant in Mexico. This facility produces several essential subcomponents for Adventure Works Cycles' product line, which are then shipped to the Bothell headquarters for final assembly. Since 2005, Importadores Neptuno has been the exclusive manufacturer and distributor of the touring bicycle product group.    Adventure Works Cycles aims to expand its market share by focusing its advertising efforts on top customers, increasing product accessibility through an external website, and lowering sales costs by optimizing production expenses. To support the data analysis requirements of the sales, marketing teams, and senior management, the company consolidates transactional data from the AdventureWorks2012 database and non-transactional information, such as sales quotas from spreadsheets, into the AdventureWorksDW2019 relational data warehouse. |
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| Bar graph with upward trend INVENTORY CONTROL   * Stock Monitoring * Demand Forecasting  List PRODUCT  OVERVIEW   * Inventory Management * Product tracking  Group brainstorm WORK ORDER COORDINATION   * Production Scheduling * Manufacturing Workflows |  | DATA STRUCTURE OVERVIEW |
| The Adventure Works Cycles database is designed to efficiently support the company's operations. Built on a relational schema, it organizes data to facilitate analysis, reporting, and day-to-day activities. The Entity Relationship Diagram (ERD) provides a clear visualization of the relationships between various tables, while primary and foreign keys play a crucial role in maintaining and understanding these connections. Key tables: Tables such as ***Product*, *Bill of Materials*,** and ***Work Order*** are used to manage product details, manufacturing components, and work orders.  The ***Product*** tables offer detailed information about Adventure Works products and the individual items linked to specific purchase orders. These tables are crucial for monitoring the progress of purchase orders, from issuance to receipt, ensuring that products procured from vendors are accurately recorded in the inventory system. The Make Flag field in the Product table indicates whether a product will be built or bought with the description:   * **0: The product is purchased from a vendor.** * **1: The product is manufactured in-house.**   The ***Bill of Materials*** table organizes the hierarchical relationships between finished goods and subcomponents, playing a vital role in supporting the manufacturing process. It is essential to track all the components required to produce bicycles and their subassemblies at Adventure Works. This table outlines the connections between parent products (e.g., a Complete bicycle or Accessories) and their components (e.g., Brakes, Chains, Helmets, tires, and tire tubes).  The ***Work Order*** table oversees manufacturing work orders, detailing the products to be produced, their quantities, and required completion timelines. It plays a critical role in aligning production schedules with inventory demands, ensuring efficient manufacturing operations. The table tracks the number of products to be manufactured, the successfully produced items added to inventory, and any that failed inspection and were discarded. It also records production start and end dates, as well as the due date for completion. Furthermore, the table identifies reasons for product failures, helping address quality issues while maintaining efficient production and proper inventory management. |

ERD (Entity Relationship Diagram):

The database diagram below illustrates the relationships between the Product table, the Bill of Materials table, and the Work Order table. The Product table contains key details such as product names, product numbers, Standard Costs, and List Prices. The Work Order table is linked to the Product table through a one-to-many relationship via the ProductID, while the Bill of Materials table connects ComponentID to ProductID in a similar one-to-many relationship.



NEXT STEPS**:** The next business analysis steps after learning about the company’s data structure:

### PRODUCTS

Adventure Works Cycles organizes its products into various models, categories, and subcategories. The company offers a total of 504 products, distributed across 295 models, 37 subcategories, and 4 main categories. Not all products are linked to subcategories, which can be identified by checking the Product Subcategory ID field in the Product table. However, every subcategory is associated with a corresponding product category.

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Product Groupings AnalysiS:

Adventure Works Cycles organizes its products into hierarchical groupings, which provide a clear structure for understanding the company’s diverse product lines. This approach enables easy analysis without being overwhelmed by excessive details.

**Product Details:**

* **Total Products:** The company offers 504 products across various categories and subcategories.
* **Product Models:** 295 product models serve as classifications for similar types of products.

**Categorization:**

* **Categories:** Products are divided into 4 major categories (e.g., Accessories, Bikes, Components, and Clothing)
* **Subcategories:** These Categories are further broken into 37 subcategories (e.g., Road Bikes, Caps, Helmets, etc.)

**Relationship Between Groupings:**

* Each Product Category encompasses multiple Subcategories, creating a broad classification of products.
* Each Subcategory includes a range of Products, and many of these products are further grouped under specific Product Models to organize similar types together.
* For example, the category "Clothing" includes subcategories such as "Jerseys" and "Caps." Within the subcategory "Jerseys," a specific product model like "Long-Sleeve Logo Jersey" may group multiple individual products under its name.

**Importance of Groupings:**

These groupings provide a structured view of the organization’s product offerings, enabling detailed analysis at different levels:

* Analyzing by Category (e.g., all "Clothing") allows a high-level overview of sales and inventory trends.
* Reviewing by Subcategory (e.g., "Jerseys") helps focus on specific product lines.
* Diving deeper into Product Models (e.g., "Long-Sleeve Logo Jersey") provides insight into the performance of specific designs or features.

The product grouping in Adventure Works Cycles plays a vital role in organizing and analyzing the company's extensive catalog of 504 products. By categorizing these into 37 subcategories and 4 overarching categories, the database provides a structured and hierarchical view of the product line. This structure allows for an in-depth understanding of how individual products relate to their respective subcategories and categories. Such an organization aids in simplifying complex datasets, enabling better inventory management, efficient reporting, and strategic decision-making. It also facilitates targeted marketing efforts by allowing stakeholders to focus on specific segments, such as a product model, subcategory, or an entire category, without being overwhelmed by unnecessary details. This approach ensures the company's operations are streamlined and customer needs are addressed effectively.

NEXT STEPS**:** The next business analysis steps after learning about the company’s products:

**EXPECTED PROFITABILITY**

Adventure Works Cycles determines expected profitability by comparing the standard costs (representing production or procurement expenses) with the list prices (the selling price) of its products. The difference between these values reveals the potential profit margin for each product, offering valuable insights into the company’s financial performance. By analyzing this information, Adventure Works can adjust its pricing strategies, prioritize high-margin products, and enhance operational efficiency to improve overall profitability while meeting market demands.

**Profit = List price – Standard Cost**

To evaluate product profitability, Adventure Works calculates the markup percentage by assessing the differential between the list price (selling price) and the standard cost (cost price) of each product. This variance is then divided by the standard cost and multiplied by 100 to derive the markup percentage, providing a quantitative measure of the product's profitability relative to its cost.

**Markup Percentage = Profit**



**Standard Cost**



By analyzing the product performance, below are the findings regarding the Expected Profitability:



**Smallest Markup Product**

AWC Logo Cap

Long Sleeve Logo Jersey

Short Sleeve Classic Jersey

**Highest Markup Product**

Mountain Bikes Socks

**Least Profitable Product**

PK-7098 Patch Kit/8

**Most Profitable Product**

Mountain-100 Silver

**Profitability Insights:**

* **Most Profitable Product:**

The **Mountain-100 Silver (BK-M82S-38,42,44,48)** is identified as the most profitable product, driven by a substantial difference between its selling price (list price) and standard cost, resulting in a high profit margin. Further analysis of product categories and subcategories reveals that **Road Bikes** is the most profitable subcategory, while **Bikes** stand out as the most profitable category overall.

* **Least Profitable Product:**

The **PK-7098 Patch Kit/8 Patches** is identified as the least profitable product, with a lower profit margin due to its relatively low list price in comparison to its standard cost. A deeper analysis of the product subcategories shows that **Caps and Jerseys** are among the least profitable categories.

* **Highest Markup:**

**Mountain Bike Socks** have the highest markup percentage, driven by the notable difference between the list price and standard cost, positioning this product as a high-margin item. A deeper analysis of product categories and subcategories shows that **Socks** have the highest markup within their subcategory, while **Accessories** emerge as the highest markup category overall.

* **Smallest Markup:**

**The AWC Logo Cap, Long-Sleeve Logo Jersey, and Short-Sleeve Classic Jersey** have the smallest markup percentages. This is due to the relatively small difference between their list prices and standard costs, making these products lower-margin items. Further analysis of product subcategories reveals that Caps belong to subcategories with the lowest markup.

Based on the analysis of product profitability at Adventure Works, certain products, such as the **Mountain-100 Silver and Mountain Bike Socks,** provide significantly higher profit margins and markup percentages, making them key drivers of the company's financial success. Conversely, products like the **PK-7098 Patch Kit/8 Patches** and certain apparel items such as the **AWC Logo Cap, Long-Sleeve Logo, and Short-Sleeve Classic Jersey** exhibit lower profitability due to smaller markup percentages. To enhance overall profitability, Adventure Works should focus on strengthening its high-margin products while reevaluating the pricing, production costs, and sales strategies for lower-margin products.

* Adventure Works should continue to promote and enhance the sales of the most profitable products to ensure a strong return on investment, as their profitability reflects efficient production processes and strong market demand.
* Adventure Works may explore strategies such as cost reduction, and supplier negotiations, or reevaluate the pricing strategy for the least profitable products to boost their profitability.
* They should capitalize on the profitability of products with the highest markup, focusing on maintaining or increasing the markup through effective pricing strategies and potentially scaling production.
* Adventure Works may need to evaluate whether products with the smallest markup are priced competitively in the market and explore opportunities for cost reduction or price adjustments to enhance their profitability.

NEXT STEPS**:** The next business analysis steps after learning about the company’s profitability:

**Customers**

Adventure Works Cycle serves two primary types of customers: **Individuals** and **Stores**. These customer types are further categorized into three variations: **Person Customers**, representing individual buyers; **Store Customers**, representing standalone businesses; and **Stores with Contact Customers**, which include stores with specific contact with people associated with them. This segmentation allows Adventure Works to tailor its approach to different customer needs and ensure efficient management of customer relationships.

### ANALYSIS:

Adventure Works primarily serves two primary kinds of customers:

1. **Individuals** (Person Customers)
2. **Stores** (Store Customers)

However, these two primary kinds lead to **three variations**:

1. **Person Customers**: Individual buyers, identified through the **Person ID** in the Customer table.

* **Count**: **18,484**
* **Examples:** Regular customers buying products for personal use.

With the highest count of 18,484, individual customers represent a significant portion of the customer base. Targeting this segment with tailored marketing strategies and loyalty programs can enhance retention and increase sales.

1. **Store Customers**: Businesses without a specific contact person, identified through the **Store ID** on the Customer table.

* **Count**: **701**
* **Examples:** Retailers or wholesalers purchasing in bulk.

Although fewer in number 701, store customers can drive substantial sales volumes. Developing strong partnerships and providing personalized support to these customers can help maximize their potential.

1. **Stores with Contact Customers**: Businesses with a specific person listed as a contact, identified by having a **Store ID** and **Person ID**.

* **Count**: **635**
* **Examples:** A store with a manager or representative who handles orders and communication.

With 635 counts, this segment can serve as a bridge between individual and store customers. Retaining these customers and offering them special promotions or incentives could help convert them into loyal store partners.

**Explanation of Variations:**

* The two primary customer types are **Person Customers** and **Stores**, based on whether the customer is an individual or a business.
* The third variation, **Stores with Contact Customers**, exists because some business customers maintain a specific contact person for communication and transactions. This structure allows Adventure Works to track the business entity and its representative, providing flexibility in managing relationships.

**Key Observations:**

* **Person Customers** form most of the customer base, indicating that individual buyers are the largest contributor to revenue.
* **Stores with Contact Customers** represent a smaller group but provide opportunities to strengthen relationships through direct communication.
* **Store Customers** without contacts are slightly more common than Stores with Contact Customers, but the absence of direct contact could be a limiting factor for fostering personalized relationships.

Based on the analysis, Adventure Works should prioritize maintaining and enhancing relationships with Person Customers, as they make up the majority of the customer base (18,484) and are likely the largest revenue contributors. Additionally, the company should focus on strengthening partnerships with Store Customers (701) and Stores with Contact Customers (635), as they provide significant potential for growth in the business-to-business (B2B) segment. Establishing direct contact with more stores could enhance communication, improve sales efficiency, and increase customer loyalty.

NEXT STEPS**:** The next business analysis steps after learning about the company’s customers:

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| Upward trend outline REVENUE TRENDS   * Analyze Sales growth * Identify top-performing product groupings  Clipboard Checked with solid fill PROFIT  MARGINS   * Evaluate Profitability across product lines * Highlight high-markup products  Pyramid with levels outline SALES PERFORMANCE   * Access sales by products, models, category and subcategory * Identify areas of improvement in sales strategies |  | **SALES OVERVIEW** |
| Adventure Works sales represent a diverse range of products as previously described, systematically grouped into models, subcategories, and categories to simplify product management and enhance customer experience. The product lineup includes high-value items like bicycles, which drive a significant portion of revenue, as well as complementary accessories such as caps, jerseys, and socks, which contribute to overall sales. This structured organization of products enables Adventure Works to analyze sales trends effectively and develop targeted strategies for revenue growth and market expansion. Key Metrics: **Sales** refers to the process of selling products to customers, which generates revenue for the company.   * **Order Quantity**: Represents the number of units of a specific product that has been ordered in a sales transaction. The total sales volume is calculated based on the order quantity for each product in the order. * **Cost**: Total production or procurement cost, calculated as Order Quantity \* Standard Cost. * **Revenue**: Total earnings from the sale, as indicated by Line Total, which reflects the actual price paid by the customer for the products ordered, accounting for any discounts applied to the unit price.   **Line Total = Unit Price \* (1 - Unit Price Discount) \* Order Quantity**   * **Profit**: Difference between Revenue and Cost, representing the earnings after covering the production or procurement cost. It is the key indicator of financial performance per sales. * **Markup Percentage**: Profit as a percentage of cost, calculated as (Profit / Cost) \* 100, which helps evaluate the profitability of a product. A higher markup percentage signifies a higher profit margin for the product.   Adventure Works analyzes key insights that highlight notable variations in performance metrics across different groupings, including products, models, subcategories, and categories. Certain products drive profitability and revenue, while others demonstrate high markup percentages, indicating successful pricing strategies. However, some items show lower profitability and revenue, pointing to opportunities for improvement in pricing or marketing efforts to enhance overall financial performance. The analysis also uncovers distinct patterns in product performance, suggesting areas of strong market demand and effective pricing, as well as opportunities for refinement in pricing or marketing strategies. |

**SALES ANALYSIS:**

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| **Product Name** | **Sum of Profit** | **Sum of Cost** | **Sum of Revenue** | **Sum of Markup Percentage** |
| **Mountain-100** |  |  |  |  |
| Mountain-100 Silver, 38 | 1487.8356 | 1912.1544 | 3399.99 | 77.8093 |
| Mountain-100 Silver, 42 | 1487.8356 | 1912.1544 | 3399.99 | 77.8093 |
| Mountain-100 Silver, 44 | 1487.8356 | 1912.1544 | 3399.99 | 77.8093 |
| Mountain-100 Silver, 48 | 1487.8356 | 1912.1544 | 3399.99 | 77.8093 |
| **Grand Total** | **5951.3424** | **7648.6176** | **13599.96** | **311.2372** |

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| **Profitability based on** | **Product** | **Product Model** | **Product Sub-Category** | **Product Category** |
| Most Profitable | Mountain-200 Black, 42 | Mountain- 200 | Mountain Bikes | Bikes |
| Least Profitable | Road-650 Red, 44 | Road-650 | Road Frames | Clothing |
| Most revenue | Mountain-200 Black, 38 | Mountain- 200 | Road Bikes | Bikes |
| Least Revenue | LL Road Seat/ Saddle | LL Road Seat/Saddle 1 | Chains | Accessories |
| Highest Markup % | Fender-Set Mountain | Fender Set - Mountain | Fenders | Accessories |
| Lowest Markup % | Long-Sleeve Logo Jersey, L | Long-Sleeve Logo Jersey | Jerseys | Components |

The analysis of expected profitability across various product groupings highlights anticipated trends in product performance, including categories, subcategories, and models. However, when comparing these expectations to actual sales results, discrepancies may arise, reflecting differences in market demand, pricing strategies, or other external factors. This comparison provides valuable insights into the effectiveness of current strategies and identifies areas for potential improvement to optimize profitability across all product lines.

COMPARISON of EXPECTED PROFITABILITY vs SALES OVERVIEW:

**1. Most Profitable Product**

* **Expected Profitability**: The most profitable product is expected to be ***Mountain-100 Silver* (BK-M82S-38, 42, 44, 48).**
* **Sales Overview**: However, the actual most profitable product is ***Mountain-200 Black, 42*.**
* **Analysis**: The *Mountain-200 Black* exceeds the expected profitability of the *Mountain-100 Silver*. This could be due to better-than-expected sales, possibly from increased demand or successful promotional efforts for the *Mountain-200 Black* model. Adventure Works should consider applying similar strategies to enhance the profitability of the *Mountain-100 Silver* product if it's underperforming.

**2. Least Profitable Product**

* **Expected Profitability**: The least profitable product is expected to be ***PK-7098 Patch Kit/8 Patches*** due to its lower price point and limited appeal.
* **Sales Overview**: The actual least profitable product is ***Road-650 Red, 44***. Despite being a more expensive item, this product underperforms in terms of profitability.
* **Analysis**: The *Road-650 Red* product underperforms compared to the expected least profitable product, *PK-7098 Patch Kit/8 Patches*. This suggests that while the patch kit was expected to have low profitability, the *Road-650 Red* model does not resonate with customers as anticipated. Adventure Works should evaluate why this model is struggling and consider adjustments in pricing or promotions to boost its performance.

**3. Most Profitable Subcategory**

* **Expected Profitability**: The most profitable subcategory is expected to be ***Road Bikes***, based on their higher prices and popularity in the market.
* **Sales Overview**: The actual most profitable subcategory is ***Mountain Bikes***.
* **Analysis**: The *Mountain Bikes* subcategory outperforms *Road Bikes* in terms of profitability, which suggests strong market demand and possibly higher-margin products in the mountain bike segment. Adventure Works should focus on further expanding the mountain bike range and enhancing its visibility to continue capitalizing on this trend.

**4. Least Profitable Subcategory**

* **Expected Profitability**: The least profitable subcategory is expected to be ***Caps and Jerseys***, given their lower price points and limited appeal compared to other products.
* **Sales Overview**: The least profitable subcategory is ***Road Frames***.
* **Analysis**: *Road Frames* underperforming compared to *Caps and Jerseys* could indicate low demand or pricing issues in the road frames subcategory. Adventure Works might explore ways to improve the sales of road frames through promotions or introducing additional product features to increase customer interest.

**5. Most Profitable Category**

* **Expected Profitability**: The most profitable category is expected to be ***Bikes***, reflecting the higher price point and market demand for bicycles.
* **Sales Overview**: In the actual results, ***Bikes*** are also the most profitable category, confirming the accuracy of the expected profitability.
* **Analysis**: The alignment between expected and actual profitability for the *Bikes* category indicates that Adventure Works’ strategy of focusing on high-demand, high-value products such as bikes is working well. The category should continue to be a primary focus to maintain strong financial performance.

**6. Least Profitable Category**

* **Expected Profitability**: The expected least profitable category was marked as ***NULL***, suggesting that no category was initially expected to perform poorly.
* **Sales Overview**: The least profitable category is ***Clothing***.
* **Analysis**: The *Clothing* category's underperformance suggests that the pricing, demand, or product offering might not be aligned with consumer preferences. To improve profitability, Adventure Works might need to reassess their clothing offerings, and promotional strategies, or even rethink the product mix within this category.

NEXT STEPS**:** The next business analysis steps after learning about the company’s sales:

## **RETAIL vs WHOLESALE**

Adventure Works sells products in both the retail and wholesale markets, catering to a diverse range of customers. Retail sales typically involve individual consumers purchasing products for personal use, often through online channels, where orders are placed without the need for a salesperson. On the other hand, wholesale sales primarily involve business customers, such as stores, who place bulk orders and may require customized pricing, terms, or personalized interaction with a salesperson. The distinction between retail and wholesale sales allows Adventure Works to effectively manage and tailor its pricing, marketing, and customer service strategies to meet the different needs of these two distinct customer groups.

**RETAIL vs WHOLESALE INSIGHTS:**

* Orders involving salespersons are often linked to wholesalers who require tailored pricing, specific terms, or bulk purchasing options.
* Conversely, orders without salespersons (such as online transactions) are typically associated with individual or retail customers who prefer self-service through online platforms, eliminating the need for direct interaction with a salesperson.
* Adventure Works primarily caters to customers through physical stores, with 99% of customers classified as "Store with Contact," reflecting minimal focus on online shopping. Notably, online orders account for just 0.005% of total sales, underscoring a significant reliance on offline sales.

**PERCENTAGE LOSS:**

* **Percentage of Loss in Retail Sales:** Retail sales generated 0% loss, indicating that retail operations were entirely profitable without any transactions incurring a negative profit margin.
* **Percentage of Loss in Wholesale Sales:** Wholesale sales generated a 217% loss, suggesting that the cost of goods sold (COGS) and associated expenses for wholesale transactions exceeded the revenue generated by a significant margin, leading to an overall negative profitability.

**PERCENTAGE VOLUME:**

* **Percentage of Volume in Retail Sales:** Retail sales contributed 21.9% of the total sales volume, reflecting a smaller share of transactions compared to wholesale, likely catering to individual customers or smaller orders.
* **Percentage of Volume in Wholesale Sales:** Wholesale sales accounted for 78% of the total sales volume, indicating that most transactions involved bulk orders, typical of B2B operations.

### Analysis of Retail vs. Wholesale Sales:

A comparison of retail and wholesale sales highlights significant differences in profitability across products, models, sub-categories, and categories.

* **Products:**
  + The most profitable retail product is **Mountain-200 Black, 46**, generating a profit of **$566,213.02**, compared to the most profitable wholesale product, **Mountain-200 Black, 38**, which brings in **$138,563.07**.
  + This indicates that retail sales drive higher profitability at the individual product level compared to wholesale sales.
* **Models:**
  + Both retail and wholesale sales identify **Mountain-200** as the most profitable product model. However, retail sales generate significantly higher profit of **$3,458,761.75**, while wholesale sales only achieve **$612,859.28**.
  + This disparity suggests that retail sales are more lucrative for this model, possibly due to higher markup rates and direct-to-consumer pricing.
* **Subcategories:**
  + For retail, the most profitable subcategory is **Road Bikes**, with profits of **$5,302,322.67**, while wholesale profitability is dominated by **Mountain Bikes**, contributing **$1,414,440.71**.
  + This variation could reflect differences in market demand, with retail customers preferring road bikes, whereas wholesalers focus on mountain bikes for bulk orders.
* **Categories:**
* The **Bikes** category emerges as the most profitable in both retail and wholesale sales. Retail profits, however, are significantly higher at **$11,112,855.74**, compared to wholesale profits of **$1,418,629.07**.
* This trend underscores the dominance of the retail segment in driving overall revenue and profitability within the category.

Adventure Works heavily relies on offline sales, with minimal engagement in online channels, and is experiencing substantial losses in its wholesale segment, particularly due to higher operational costs or lower margins associated with bulk sales. Retail sales, on the other hand, generate consistent profits but constitute a smaller portion of total sales volume.

**Most Important Insight:** The critical takeaway is the significant financial loss from wholesale sales despite their large volume, compared to the stability and profitability seen in retail sales. This highlights the need to reassess the wholesale structure to improve profitability.

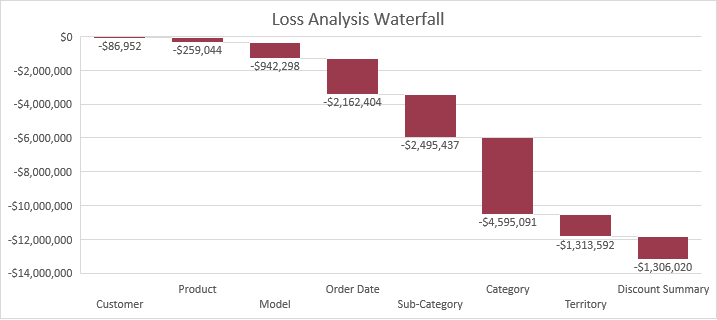
**Least Important Insight:** The breakdown of sales by volume across individual products, models, subcategories, and categories mirrors the overall wholesale-retail distribution (78% and 22%) and does not substantially influence the broader conclusions about profitability and losses on each sales channel.

NEXT STEPS**:** The next business analysis steps after learning about the company’s retail vs wholesale distribution:

## **ANALYSIS**

Adventure Works’ loss analysis reveals critical insights into the company’s financial performance across its sales channels. It appears that the sales with losses tend to be more concentrated within the wholesale segment, despite their high sales volume. This suggests that certain factors such as discounts and special offer discounts could be contributing to the financial losses. Wholesale sales often involve bulk purchases and customized pricing, which may lead to lower margins or deeper discounts than initially anticipated. The range of discounts in wholesale could be excessive, leading to reduced profitability for these transactions.

Additional factors, such as the role of customers, territories, and countries, may also be linked to the losses. For instance, certain sales regions may have lower-performing sales teams, leading to missed opportunities for upselling or reducing unprofitable discounts. Specific sales reasons and order dates may also provide insight into periods where promotional activities or special deals disproportionately impacted profitability.



### LOSS ANaLYSis:

The total loss across all categories amounts to **-$5,034,387.64**

* **High Price Reductions Without Additional Incentives**:
  + **Significant price reductions**, such as **46.4%** and **40.0%**, along with a **0.0%** discount offer (no additional incentive), are major contributors to the overall losses.
  + These deep cuts in prices without compensating offers or strategies to drive higher volumes are significantly affecting profitability.
* **Discount Combinations Impact:**
  + Combining price reductions with volume-based discounts, like **Price Reduced: 55.0%** with a **Volume Discount of 15.0%** for quantities between 41-60, results in **lower losses**.
  + This suggests that using a mix of volume-based incentives alongside price cuts helps balance customer acquisition with maintaining profitability, possibly due to increased sales volume offsetting the discount effect.
* **Sales Reason vs Discount Strategy:**
  + **Sales reasons**, such as Television advertisement, magazine advertisement promotional events, or sponsorship, do not appear to have a significant impact on the losses.
  + The primary causes of the losses seem to be **pricing and discount strategies**, with aggressive price reductions being the most influential factor. This indicates that pricing strategies are the central element affecting profitability rather than the underlying sales motivations or customer segments.
* **Losses Concentrated in Specific Categories and Territories:**
  + Categories like **Bikes** and **Road Bikes** are experiencing the largest losses, largely due to high price reductions on those products. Similarly, the **Southwest US territory** stands out, with substantial losses tied to sales in this region.
  + The concentration of losses in these specific categories and regions suggests that both geographical factors and product category dynamics amplify the negative impact of certain discounting strategies, warranting targeted strategy adjustments in these areas.
* **Date and Timing: Order**
* The **Year 2013** shows significant losses. This indicates that sales performance in this specific period was underwhelming, which could be attributed to market conditions, competition, or ineffective promotional strategies during this year. It could also reflect poor demand forecasting or inventory management.
* **Customer Specific Losses:**
* The **customer "Vigorous Exercise Company"** accounts for **$86,952** in losses, which suggests that specific customers may be contributing to losses. Factors such as unprofitable contracts, returns, or dissatisfaction with product quality could play a role here. Investigating customer satisfaction, payment terms, and contract conditions may help mitigate losses from such customers in the future.

Adventure Works is losing money primarily due to **aggressive price reductions** across high-loss subcategories, particularly in **Bikes** and **Road Bikes**. The combination of significant price cuts without additional incentives or volume-based discounts is contributing to a substantial portion of the total losses. Additionally, losses are concentrated in specific **territories** like the **Southwest US**, which indicates that geographical factors may amplify the impact of discount strategies.

NEXT STEPS**:** The next business analysis steps after learning about the company’s loss:

### RECOMMENDATIONS

Adventure Works faces significant losses driven by high price reductions, particularly in categories like Bikes and subcategories like Road Bikes, with the Southwest US region showing the most impact. While discounting strategies play a major role in profitability, high-volume products with low margins contribute to overall losses. Conversely, high-profit models and categories such as Mountain Bikes present opportunities for focused marketing and sales efforts. Customer segmentation, refined discount strategies, and improved sales team training can address these challenges and boost profitability.

**1. Focus on Profitable Products, Models, Subcategories, and Categories:**

* **Prioritize High-Profit Product Categories and Models:** Identify top-performing products with the highest profit margins using sales data. Direct marketing and sales efforts toward these items. For instance, if models like Mountain-200 or categories like Mountain Bikes show strong profitability, dedicate resources to promote them more extensively.
* **Optimize High-Profit Models:** Focus on high-margin models and consider bundling them with accessories or higher-margin items to increase the overall profitability per transaction.
* **Promote Profitable Categories:** Enhance the visibility of profitable categories, such as Mountain Bikes, through strategic promotions and advertising campaigns. Position these as premium offerings in marketing materials to attract customers willing to pay higher margins, while minimizing the use of significant discounts.

**2. Reevaluate and Optimize Discount Strategies:**

* **Reduce Aggressive Discounts:** Minimize substantial price cuts, particularly in loss-heavy categories like Bikes and Road Bikes. Shift the focus to volume-based or tiered discounts that encourage bulk purchases while protecting profit margins.
* **Introducing Bundle Discounts:** For high-volume, low-margin products, implement bundle discounts. For example, offer deals on bike accessories when purchased with a bike to increase the average transaction value and overall profitability.
* **Targeted Special Offers:** Design special offers tailored to specific customer segments, such as first-time buyers, loyal customers, or underperforming regions. Ensure these discounts align with profitability objectives.
* **Monitor and Refine Discount Strategies:** Regularly evaluate the impact of discount strategies on both sales volume and profitability. Adjust discounting approaches based on insights from sales data, customer behavior, and evolving market trends to maintain effectiveness.

**3. Regional Recommendations:**

* **Address High-Loss Territories:** The Southwest US region has a strong association with significant losses. Reassess pricing strategies and promotional efforts in this area. Analyze regional consumer behavior, competitor pricing, and preferences to refine discount strategies and improve profitability.
* **Implement Localized Promotions:** Develop region-specific marketing campaigns for popular models like Road Bikes or Mountain Bikes. Tailor promotions to align with the preferences and purchasing habits of local customers while maintaining profitability.
* **Expand Focus on Profitable Regions:** Identify regions with consistently high profitability and allocate more resources toward expanding market presence in these areas. Invest in targeted marketing and sales efforts to capitalize on regions that drive higher margins.

Pros and Cons of Recommendations

**1**. **Focus on High-Profit Products, Models, Subcategories, and Categories:**

* **Pros:**
  + Increases revenue by prioritizing successful product lines.
  + Reduces reliance on underperforming products, improving overall efficiency.
  + Promotes a stronger market position for premium offerings.
* **Cons:**
  + May reduce variety in promotions, impacting customer satisfaction.
  + Risk of saturating the market for high-margin products.

**2. Reevaluate Discount Strategies:**

* **Pros**:
  + Protects margins by avoiding excessive price reductions.
  + Encourages higher sales volumes through tiered discounts and bundling.
  + Aligns pricing strategies with profitability goals.
* **Cons:**
  + Reduced discounts may alienate cost-sensitive customers.
  + Bundling and tiered discount strategies require careful planning and monitoring.

**3. Regional Recommendations:**

* **Pros:**
  + Addresses region-specific challenges, reducing localized losses.
  + Expand opportunities in profitable territories.
  + Increases market share in underperforming areas.
* **Cons:**
  + Requires significant investment in regional market analysis.
  + Tailored strategies may complicate overall operations.

**Alternative Actions:**

* Explore dynamic pricing strategies to adapt to market trends in real-time.
* Diversify product offerings to meet emerging consumer preferences.
* Strengthen customer loyalty through reward programs and after-sales support.

Recommended Course of Action

1. **Leverage High-Performing Products:** Focus marketing and sales efforts on profitable products like Mountain Bikes and high-margin models such as Mountain-200. Implement targeted campaigns to capture premium customers while ensuring these products are highlighted in both high-demand and loss-heavy territories.
2. **Refine Pricing and Discount Strategies:** Avoid heavy discounts, especially in loss-heavy categories like Road Bikes.
3. **Target Regional Opportunities:** Tailor promotions for loss-heavy regions like the Southwest US to better align with local preferences. In parallel, expand focus on regions that already generate strong profits, reinforcing brand presence and driving sales.
4. **Monitor and Adjust Regularly:** Use data analytics to track performance across products, regions, and discount strategies. Regular evaluations will ensure adjustments are timely and aligned with profitability goals.

## Problem-Solving Skills

Solving business analytics problems involves a structured approach to uncover insights, address challenges, and drive actionable decisions. It requires combining technical skills, critical thinking, and effective communication. The key is understanding the business context, accurately identifying the problem, and using data-driven methods to propose solutions.

In tackling business analytics problems, I focused on maintaining transparency by clearly documenting and communicating the methodologies, assumptions, and limitations of my analysis. I began by thoroughly understanding the purpose of the analysis and gathering relevant data from multiple tables to ensure data accuracy and alignment with business needs. I validated the data to confirm its reliability and analyzed it to uncover insights. From there, I explored alternative solutions from a business perspective and applied statistical methods and calculations to ensure accuracy and answer key business questions. Finally, I formulated actionable recommendations to provide a clear and effective path forward.

## Technical Skills

I developed a strong foundation in **Structured Query Language (SQL)** using **Microsoft SQL Server, Excel, Visual Studio**, focusing on managing and analyzing relational databases. I wrote complex queries to extract, transform, and aggregate data efficiently, enabling me to draw insights from large datasets. I also worked on optimizing database performance, joining multiple tables, and leveraging advanced SQL functions for business problem-solving.

### eRD and data dictionaries

I focused on creating **Entity-Relationship Diagrams (ERDs)** and **Data Dictionaries** specifically for a database in **Microsoft SQL Server**. The goal was to understand how to structure and organize data effectively within a relational database system, while also ensuring the relationships and constraints were documented. Using MS SQL Server as the platform, I explored how to translate business requirements into logical database designs.

* **Create an ERD of Relevant Tables**:
* Used **Database Diagrams in SQL Server Management Studio (SSMS)** to create and visualize relationships between tables.
* Developed a comprehensive **Entity Relationship Diagram (ERD)** that visualized key tables related to the Product, including relationships and dependencies.
* Mapped out **primary keys**, **foreign keys**, and table relationships, including **one-to-one**, **one-to-many**, and **many-to-many** connections.
* **Use of Data Dictionary**:
* Referred to the **Data Dictionary** to interpret table structures, field definitions, and data types.
* Used this knowledge to identify key columns such as **ProductID, ComponentID,** and other relevant attributes for the analysis.
* **Understand Foreign Keys**:
* Identified and analyzed **foreign keys** and the fields they pointed to in related tables. For instance:
  + **ComponentID** in the **Bill of Materials** table referenced the Primary key ProductID in the **Product** table.
  + **ProductID** linked the **Product** and **Work Order** tables.
* **Explain Business Concepts Using ERD and Data Dictionary**:
* Used the ERD and Data Dictionary to explain the flow of data and relationships between tables, such as how Product Subcategories are grouped into Categories.

The most valuable insight from this assignment was understanding how relational databases are structured and how foreign keys enforce relationships between tables. By creating the ERD and analyzing the Data Dictionary, I developed a clear understanding of how data flows through the database and supports business processes. This assignment reinforced the importance of visualizing data structures for better problem-solving and decision-making in real-world business scenarios. It also highlighted how database design and relationships directly impact business operations, making it easier to translate technical structures into actionable business insights.

### Joins and where clauses

I explored the relationships between the **ProductCategory**, **ProductSubCategory**, and **Product** tables by creating a Database Diagram (ERD) and executing various SQL queries. This requires listing all contents of the Product table, performing joints to include related fields from ProductSubCategory and ProductCategory, and identifying rows where ProductSubCategory data is missing. Additionally, I formatted date, numeric, and money fields to display them in the correct formats and verified the total number of rows by executing a SELECT \* FROM PRODUCT query to ensure accuracy and alignment with the query's goal.

* **SQL Joins**:
* Gained hands-on experience writing **INNER JOINs**, **LEFT JOINs**, and **RIGHT JOINs** to merge data from related tables.
* Learned to join multiple tables efficiently to retrieve hierarchical information from the database.
* **WHERE Clause**:
* Practiced filtering data using **WHERE** conditions to extract specific insights, such as rows where a ProductSubCategory is not NULL
* **Formatting Outputs**:
* Learned to format **date**, **numeric**, and **money fields** using SQL functions to ensure readability and alignment with reporting standards.
* For example, formatted monetary values with the correct currency symbols and decimals and converted dates into a user-friendly format.
* **Verifying Row Counts**:
* Used the **SELECT \* FROM PRODUCT** query to confirm the total number of rows in the Product table, ensuring the join results matched expectations and no data was unintentionally omitted.
* **Handling Missing Data**:
* Analyzed rows with missing ProductSubCategory data and correlated other fields, like **Make Flag or Finished Goods Flag**, to identify patterns and derive business insights.
* **Business Interpretation:**
* Interpreted the significance of missing subcategories, such as their implications for inventory classification or standalone products, and connected these insights to decision-making processes.

The most valuable aspect of this assignment was mastering **SQL joins** and understanding how to use them effectively to combine data from related tables for insightful analysis. Additionally, formatting outputs like **dates**, **numbers**, and **monetary fields** taught me how to enhance the usability of query results in business reporting. Finally, the importance of verifying query results, particularly the row count, was a crucial lesson in ensuring data integrity and accuracy. The ability to translate missing data insights into actionable business recommendations was another significant highlight of this assignment.

### Maths anD aggregates

I worked with ProductCategory, ProductSubCategory, Product Model, and Product tables to calculate and analyze profits and profit percentages for various products. I created a Database Diagram (ERD) of the relevant tables, executed SQL queries to **calculate profit and profit percentage,** and summarized these metrics by ProductSubCategory and ProductCategory. This involved sorting the results in different ways to extract meaningful insights. Additionally, I explored why certain types of products were absent from the results and analyzed whether the focus should be on selling products with high profit or high profit percentage.

* **Math Operations in SQL**:
  + Learned to perform mathematical calculations in SQL queries to derive fields like:

**Profit (List Price - Standard Cost)** and

**Markup Percentage** (**Profit / Standard Cost \* 100)**

* **Aggregates**:
  + Used aggregate functions like **SUM ()**, **AVG ()**, **COUNT ()**, **MAX ()**, and **MIN ()** to summarize profits and profit percentages at different levels (e.g., by ProductSubCategory and ProductCategory).
* **Sorting Results**:
  + Learned to use the **ORDER BY** clause to sort data based on calculated fields like profit or markup percentage in ascending and descending orders to extract different perspectives.
* **Importance of GROUP BY:**
* Learned that **GROUP BY** is not only essential for aggregations but also for organizing data into meaningful categories (e.g., grouping products by subcategories or categories).
* Understood its importance in fields where mathematical operations are not directly applied but where data needs to be segmented for better understanding and reporting. For example, grouping by Product Model or ProductSubCategory to evaluate their performance trends.
* **Joins and Filtering**:
  + Practiced writing SQL queries with **one** and **two joins** to merge data across multiple tables.
  + Enhanced the ability to filter and analyze data based on specific criteria, such as identifying missing product types or subcategories.
* **Data Interpretation**:
  + Developed the ability to analyze and interpret results by identifying patterns in profitability, understanding missing data, and evaluating which products should be prioritized for sales based on business strategy.

The most valuable aspect was learning to perform mathematical operations and aggregations in SQL to derive key performance metrics. This skill is critical for financial and business analysis, enabling the extraction of actionable insights from raw data. Understanding how to structure multi-table queries with joints and groupings was another important takeaway.

### REPORTING

I focused on learning how to create and format reports using **SQL Server Reporting Services (SSRS)** within **Visual Studio**. The goal was to generate reports that could effectively present query results in a readable format. I learned to create reports both **with and without using the report wizard**. This involved connecting Visual Studio to SQL Server using a connection string, manipulating report components such as the **header, footer, and body**, and organizing data into clear, understandable formats through grouping and sorting techniques. These reports were designed to present results that stakeholders could easily interpret.

* **Report Creation in Visual Studio**:
* Learned how to use both **wizard-based** and **non-wizard-based** methods to create reports in **Visual Studio**.
* Gained skills in connecting **Visual Studio** to **SQL Server** using connection strings, ensuring seamless data retrieval for report generation.
* **Report Design and Structure**:
* Gained knowledge of the different parts of a report, including the **header**, **footer**, **body**, and **groupings**.
* Learned how to manipulate these parts to make the report more organized and visually appealing.
* **Formatting and Customization**:
* Developed the ability to format reports by adjusting fonts, layout, and design elements to enhance readability and make reports more accessible to non-technical users.
* **Grouping and Sorting**:
* Practiced grouping data within the report to provide a clear and structured way of presenting results.
* Gained skills in sorting data within the report to highlight key findings.
* **Connecting and Integrating Data**:
* Enhanced my ability to connect databases to reporting tools and integrate SQL query results into reports, ensuring that the information displayed was accurate and up to date.

The most valuable thing I learned in this assignment was mastering the creation and formatting of reports in **Visual Studio**. This experience gave me a deep understanding of how to present data in a way that is both clear and useful to stakeholders. One key takeaway was the importance of putting **all relevant column fields on one page** to make the report effective and ensure that stakeholders can easily understand the data. By organizing and displaying all necessary information in a clear, concise manner, the report becomes more user-friendly and accessible. This format helps avoid unnecessary scrolling or confusion, allowing the reader to view the complete dataset briefly. Additionally, connecting Visual Studio to SQL Server and using it to generate reports allowed me to understand how reports are built from raw query data and how to manipulate the report to fit the needs of the audience. This skill will be critical in any future role where presenting data-driven insights clearly and effectively is required.

### CASE and Concatenate clauses

The goal was to explore and analyze customer data within the Adventure Works database. I created an ERD to understand the relationships between the **Customer, Store,** **Person**, and **Sales Order Header** tables. The main task was to write SQL queries to retrieve and manipulate customer data, such as generating full customer names by joining fields from different tables using **CONCAT** and counting customers based on their types. Additionally, I used **CASE** statements to categorize customers and applied aggregation functions to understand customer distribution. This assignment helped me grasp how data is split across tables and how SQL can be used to generate insightful reports and business analyses.

* **Using the CASE Statement**:
* The **CASE** statement in SQL allowed me to apply conditional logic to customer data.
* For example, I could categorize customers based on certain conditions, such as grouping them into different customer types or statuses based on their purchase behavior or other attributes.
* **Concatenating Text Fields**:
* To create a **full customer name**, I learned how to concatenate **FirstName**, **MiddleName** and **LastName** fields in SQL.
* This was useful because the **Customer** table did not have a direct "Customer Name" field, but instead, the first, middle and last names were stored separately in the **Person** table.
* By using the **CONCAT ()** function, I was able to combine these two fields into a single displayable name.
* **Evaluating Business Context Through SQL Queries**:
* This also reinforced the importance of understanding the business context when querying databases.
* For instance, knowing why certain fields like customer names are split across multiple tables helped me better interpret the data from a business perspective.

The data is structured in a way that ensures no null values are present for each customer type, with distinct fields to identify the customer’s type:

1. **Person**: Individual customers are identified by **Person ID** on the Customer table, which represents personal details for retail customers.
2. **Store**: The **Store ID** in the Customer table identifies customers who represent a store or business entity.
3. **Store with Contact**: For customers who are associated with both a store and individual contact, both **Person ID** and **Store ID** are used to identify them in the Customer table.

One of the key insights was how data related to customers, such as their names and types, is spread across different tables like **Person** and **CustomerType**. This required using **JOIN** operations to bring the data together and analyze it effectively. Understanding this structure was essential for creating meaningful reports and insights. The **CASE** statement was incredibly useful for transforming and categorizing data based on specific conditions. This conditional logic made the SQL queries more dynamic and tailored to specific business needs. Learning how to combine fields using the **CONCAT ()** function was crucial for creating clean, readable outputs.

### Complex math and aggregation

I focused on analyzing product profitability within the **Adventure Works** database. The main objective was to understand the sales data and how different products, product models, subcategories, and categories contribute to profitability. The primary tasks involved creating complex **SQL joints** to identify which tables contributed most to sales and profitability. Additionally, I calculated profit and profitability percentages using **complex math operations**, including brackets for accurate order of operations, and applied **ORDER BY** clauses to sort data and identify the most and least profitable products, models, subcategories, and categories. I also performed aggregations to summarize these metrics and used SQL queries to analyze profitability at different levels of granularity.

* **Complex Joins**:
* Mastered **INNER JOIN**, **LEFT JOIN**, and **CROSS JOIN** to combine multiple tables and retrieve detailed sales data.
* Used JOINs to link tables like Product, SalesOrderDetail, ProductModel, ProductCategory, and ProductSubCategory to track sales and profitability across different dimensions.
* **All Sales**:
* Focused on aggregating **total sales data**, including quantities sold and total profit and revenue, across different product categories and subcategories.
* This analysis provided a high-level understanding of how different products contribute to overall revenue.
* **Mathematical Calculations with SQL**:
* Learned to perform **complex math** calculations involving profit margins and profitability percentages, accounting for precise order of operations using brackets.
* Applied formulas to calculate:

**Cost** (Order Quantity \* Cost)

**Profit** (Revenue - Cost)

**Markup Percentage** (Profit/Cost \* 100)

* **Sorting and Evaluating Data**:
* Gained experience using **ORDER BY ASC and DESC** to sort product profitability data, identifying the highest and lowest profitability for products, models, subcategories, and categories.
* Analyzed how sorting impacts insights and facilitates decision-making, such as identifying the most and least profitable products.

The most important takeaway was the ability to perform complex SQL joints to merge data from multiple tables, allowing for a more comprehensive view of product profitability. I learned how to calculate metrics like profit margin and profitability percentages using mathematical operations, ensuring I accurately computed values by understanding the **brackets** and **order of operations** in formulas. Using **ORDER BY ASC and DESC** to evaluate and sort profitability from highest to lowest helped me understand the performance of individual products, models, subcategories, and categories. This hands-on experience sharpened my ability to analyze complex data relationships, calculate financial metrics, and derive meaningful insights from business data.

## **Excel integration and visualization**

I was tasked with analyzing retail and wholesale sales performance to identify the most and least profitable product models, categories, and subcategories. This requires applying both SQL queries and Excel techniques to retrieve, calculate, and present the data in a way that highlights critical business insights. A key part of the work involved using the **DISTINCT** keyword to eliminate duplicate entries and ensure that only unique values were considered in the analysis. I created custom profit and loss fields in **Excel** to assess profitability across various dimensions. Utilized **pivot tables** to aggregate and analyze sales data, applying filters to identify the highest and lowest profitability areas. Additionally, built **bar charts** and **column charts** to visually represent these findings, making the insights easier to digest for stakeholders. The report provided not just numbers, but a clear, actionable summary of the data.

* **Analyzing Data through Pivot Tables in Excel**:
* I leveraged **Pivot Tables** in Excel to summarize and analyze the profitability of each product model, category, and subcategory. Pivot tables helped group sales data by different dimensions (e.g., product model, subcategory) and quickly calculated key metrics like total profit, total sales, and loss for each segment.
* Applied **filters** and **sorting** within Pivot Tables to highlight the most and least profitable categories and models for both retail and wholesale sales.
* **Creating Visualizations**:
* Developed **bar charts** and **column charts** in Excel to visualize profit and loss distribution across product models, categories, and subcategories. These visualizations helped to communicate which areas were the most profitable and where losses were occurring.
* Used **color-coded charts** to easily distinguish between profitable and non-profitable items, making it easier for stakeholders to interpret the data.
* **Business Analysis and Reporting**:
* Focused on presenting key insights through **visualizations** like bar charts to illustrate the **profit and loss distribution**, providing a clear understanding of the financial health of different product lines.
* Focused on providing clear and actionable insights through Excel-based reports for all product groups.

The most important takeaway was understanding the critical role of filtering and refining data to ensure accurate insights. By using the DISTINCT keyword, I learned how to eliminate duplicates in SQL queries, ensuring that only unique records were considered in the analysis. This helped streamline the reporting process and made the data more meaningful. Additionally, the process of analyzing profitability at different levels—such as product models, categories, and subcategories—highlighted how granular data can provide insights into specific areas of a business. Creating pivot tables in Excel allowed for deeper analysis of profit and loss trends for various products, making it easier to identify key drivers of profitability. Visualizing this data using bar charts made the distribution of profits and losses more accessible and comprehensible, especially when comparing retail and wholesale performance. This process also emphasized the importance of structuring data queries and reports efficiently, ensuring that they are both informative and actionable for business decision-making.

## **DATA WAREHOUSE implementation**

I explored the fundamental concepts behind **Data Warehousing (DW)** and its distinction from **Online Transaction Processing (OLTP) systems**. The primary goal was to understand how data from an OLTP database is mapped into a Data Warehouse and how the structure of a DW database is optimized for analytical queries. This involved analyzing how certain data fields are either directly transferred, calculated, or mapped from one system to another. I learned about the different data fields in DW, including fact and dimension tables. This requires mapping OLTP fields to corresponding DW fields in MS SQL Server, ensuring the data was structured in a way that supported complex reporting and analytics.

* **Data Warehouse Structure:**
* Gained knowledge of how data is structured in a DW, including facts and dimensions.
* **OLTP vs. DW Understanding:**
* Gained clarity on the differences between OLTP databases (transaction-oriented) and DW databases (analytical and reporting-oriented).
* **OLTP to DW Data Mapping:**
* Mastered the process of mapping data from an OLTP system to a DW database, ensuring proper alignment for reporting.
* **Field Categorization:**
* Developed the ability to categorize fields based on their nature (direct, calculated, or uncertain), such as recognizing when fields involve complex calculations or algorithms.
* **Data Calculations and Transformations:**
* Understood how some data in a DW is derived through calculations or sourced from other systems.
* **ETL process:**
* Implemented DW mapping for data extraction, transformation, and loading (ETL) processes.

The insights gained about the ETL process were vital in understanding how data flows from transactional systems to analytical systems, and how fields are either directly mapped, calculated, or generated through logic. Recognizing these steps deepened my appreciation for the complexities of building a well-structured data warehouse and underscored the importance of maintaining data integrity throughout the extraction, transformation, and loading stages. I learned how OLTP fields, such as product details or transactional information, are transformed and mapped into a DW schema designed for analysis and reporting. This process includes identifying fields that are directly mapped (e.g., foreign keys), calculated (e.g., extended amounts of data or time-related), and transformed using algorithms. This experience reinforced the significance of clear field mapping and data transformation to ensure precise data reporting and informed decision-making.

## **SubQueries and row to column pivot**

The goal was to analyze the losses incurred by Adventure Works using SQL Server queries and Excel. I began by creating a **subquery** in SQL Server to extract specific data points related to the losses, focusing on the sales reason behind these losses. This included converting sales reasons from rows to columns, which helped in better categorizing and summarizing the loss data. Additionally, the results were exported to Excel, where I created pivot tables to further analyze the losses. In Excel, I used aggregation functions like **SUM and COUNTIF** and created a **"Discount Summary"** column by concatenating different discount-related fields to provide a clearer picture of the losses.

* **Subqueries in SQL**:
* Learned how to use subqueries to extract detailed data, particularly focusing on converting sales reasons from rows to columns. This process helped organize the data better for analysis.
* **Pivot Functions in SQL**:
* Learned how to use SQL's pivot function to transform row-based sales reason data into columns, making it easier to identify and analyze sales patterns.
* **Excel Pivot Tables**:
* Gained proficiency in creating and manipulating pivot tables in Excel to aggregate and summarize data effectively.
* **Data Aggregation in Excel**:
* Learned how to use Excel's SUM and COUNTIF functions to calculate totals and frequencies for various data points.
* **Text Concatenation in Excel**:
* Learned how to concatenate multiple fields in Excel to generate the "Discount Summary" column, which provided a detailed view of the discount information.

The most important takeaway from this assignment was understanding how to convert sales reasons from rows to columns using subqueries and SQL pivot functions. This transformation allowed me to categorize and analyze loss data more effectively. Additionally, I learned the importance of bridging data between SQL for extraction and Excel for detailed analysis. Pivot tables in Excel helped me summarize large datasets, and I gained valuable experience in aggregating data with functions like SUM and COUNTIF. The ability to combine and manipulate fields, such as creating a "Discount Summary" column, was crucial for enhancing the clarity of the analysis. This process of data extraction, transformation, and analysis solidified my understanding of how to derive actionable insights from complex datasets.

## **Summary**

In today's data-driven world, the ability to analyze, report, and visualize data effectively is a crucial skill across various industries. My experience in SQL, reporting, and data visualization has equipped me with the tools and knowledge necessary to support data-driven decision-making in business environments.

* I have gained proficiency in querying and manipulating large datasets using SQL, transforming raw data into meaningful insights.
* Additionally, I have experience in integrating SQL with reporting tools like Excel, where I create pivot tables, charts, and advanced functions for deeper analysis.
* I am also skilled in using visualization platforms like Power BI, Tableau, and Visual Studio to create interactive dashboards and reports.
* My knowledge extends to designing Entity Relationship Diagrams (ERDs) in SQL, which helps in understanding and optimizing database structures.
* Furthermore, I have hands-on experience in data mining and the ETL (Extract, Transform, Load) process, enabling me to efficiently gather, transform, and load data for analytics purposes.
* This combination of skills allows me to extract valuable information, clean and organize it, and present it effectively to drive strategic decisions and business success.
* **SQL Skills: Data Retrieval and Manipulation:**
* **Data Extraction**: Proficient in writing complex SQL queries to retrieve data using **JOINs**, and **subqueries** from multiple tables.
* **Data Aggregation**: Able to aggregate and summarize data using functions like **COUNT**, **SUM**, and **AVG** to analyze key metrics such as sales, profit, and performance.
* **Advanced SQL Functions**: Skilled in using **CASE** statements, **PIVOT**, and **GROUP BY** to categorize data and transform rows into columns for better analysis.
* **Data Transformation**: Experienced in cleaning and transforming raw data into usable formats by applying conditional logic, performing calculations, and identifying key relationships.

Query

Select [Customer Name],

[Total Loss] = Format (sum([Total Profit]), 'c2', 'en-us’)

from (select [Customer Name] = (case

when . . .

when storeid is not null

and personid is not null

then concat(s.name, ' - ', lastname, ', ', firstname, ' ',

Case when middlename is null

then ' '

when len(middlename) = 1

then concat(middlename, '.')

when len(middlename) > 1

then middlename

else 'ERROR' end)

else 'ERROR' end)

, [Total Profit] = linetotal - (OrderQty \* StandardCost)

from sales.salesorderdetail as SOD

left join production.product as PRD

on sod.ProductID = prd.ProductID

left join . . .

Where (linetotal - (OrderQty \* StandardCost)) < 0

) as SalesData

Group by [Customer Name]

Order by [Customer Name] asc

Calculated Fields

Subquery

Data Aggregation

Data Formatting

Functions

Concatenation

Math Calculations

Logic / Case Statements

Aliases

Table Joins

Query Indentation for maintainability

Data Filtering

Data Sorting

* **Reporting: Data Analysis and Communication:**
* **SQL-Based Reporting**: Created detailed SQL reports to monitor KPIs such as sales performance, profit margins, and customer behavior.
* **Excel Reporting**: Exported SQL query results into **Excel**, creating pivoted tables, charts, and financial models to analyze data and communicate business insights.
* **Loss and Profit Analysis**: Used pivot tables and Excel formulas like **SUMIF** and **COUNTIF** to track losses, discounts, and sales reasons, helping businesses identify profitable opportunities and areas for cost reduction.

A screenshot of a computer screen

Description automatically generated

Excel Charts

Excel Pivot Tables

A screenshot of a report

Description automatically generated

SQL Servers Reporting Services reports

* **Tool Integration: Visualization:**
* **PowerPoint Presentations**: Created professional and visually compelling PowerPoint presentations to communicate data insights, business trends, and performance metrics, incorporating charts, graphs, and visualizations for clearer understanding.
* **Visualization with Power BI/Tableau**: Designed interactive dashboards and data visualizations to track business performance and provide stakeholders with intuitive insights.
* **Data Connection**: Integrated SQL databases with Excel and visualization tools to ensure real-time reporting and data accuracy.
* **Visualization with Visual Studio (Wizard-based and Non-Wizard)**: Utilized both wizard-based tools and custom coding in Visual Studio to create dynamic data visualizations, enabling easy drag-and-drop functionality for quick insights, as well as custom-built solutions for more complex reporting and analytics needs.

A close-up of a data warehouse structure

Description automatically generated

PowerPoint Presentations

A graph with blue squares

Description automatically generated A graph of different colored bars

Description automatically generated

Tableau Dashboard

Power BI Dashboard

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**ADVENTURE WORKS BUSINESS REPORT**

University of Arkansas at Little Rock

Submitted by

Anjali Sharma

T00720931