Tech Saksham

Case Study Report

Data Analytics with Power BI

"Supply Chain Analysis of Inventories"

"Sakthikailash Women's college, Dharmapuri."

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ABSTRACT

This study explores the optimization of supply chain inventories through the utilization of Power BI as a data analysis tool. Leveraging Power BI's capabilities, the research aims to delve into the complexities of inventory management within the supply chain, focusing on factors such as demand variability, lead times, and transportation costs. By integrating data from various sources including ERP systems, inventory databases, and external market data, the study seeks to provide a comprehensive analysis of inventory levels across the supply chain network. Through interactive visualizations and dashboards created in Power BI, stakeholders can gain insights into inventory trends, identify inefficiencies, and make informed decisions to optimize inventory levels and reduce costs. Additionally, the project explores predictive analytics and forecasting models within Power BI to anticipate future demand patterns and optimize inventory planning. Overall, this research contributes to advancing supply chain management practices by demonstrating the efficacy of Power BI in conducting thorough inventory analysis and driving data-driven decision-making processes.

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CHAPTER 1

INTRODUCTION

- **Problem Statement**

Effective inventory management is crucial for optimizing supply chain performance and reducing costs. However, traditional methods often lack real-time insights and struggle to handle the complexities of modern supply chains, leading to overstocking, stockouts, and increased operational expenses.

- **Proposed Solution**

This study proposes leveraging Power BI, a powerful business intelligence tool, for supply chain analysis of inventories. By harnessing Power BI's capabilities in data visualization, real-time analysis, and predictive analytics, organizations can gain deeper insights into their inventory management practices and make informed decisions to enhance efficiency and reduce costs.

Feature:

The integration of Power BI enables organizations to visualize inventory data in real-time, allowing stakeholders to monitor inventory levels, track supply chain performance, and identify potential bottlenecks or inefficiencies. Additionally, Power BI's advanced analytics features facilitate customer segmentation, trend analysis, and predictive modeling, enabling organizations to anticipate demand patterns and optimize inventory planning.

- **Real-Time Analysis**: Power BI enables real-time analysis of inventory data, providing stakeholders with up-to-date insights into inventory levels, demand fluctuations, and supply chain dynamics. This real-time visibility allows organizations to respond promptly to changing market conditions and customer demands, ensuring optimal inventory levels and minimizing stockouts or overstocking situations.

- **Customer Segmentation**: By leveraging Power BI's capabilities for customer segmentation, organizations can analyze customer purchasing behaviors, preferences, and trends. This enables targeted inventory management strategies tailored to different customer segments, enhancing customer satisfaction and loyalty.

- **Trend Analysis**: Power BI facilitates trend analysis by visualizing historical inventory data and identifying patterns, seasonality, and trends.

• Advantages

The adoption of Power BI for supply chain analysis of inventories offers several advantages, including improved data visibility, enhanced decision-making capabilities, and reduced operational costs.

- **Data-Driven Decisions**: This enables organizations to align inventory management practices with strategic objectives, optimize resource allocation, and mitigate risks associated with inventory fluctuations.

- **Improved Customer Engagement**: To improve customer engagement by ensuring product availability, reducing lead times, and enhancing order fulfillment processes. This results in higher customer satisfaction levels and increased loyalty..

- **Increased Revenue**: Increased revenue opportunities through reduced stockouts, minimized inventory holding costs, and improved product availability

• Scope

The scope of this study encompasses the application of Power BI for supply chain analysis of inventories across various industries and sectors. It aims to demonstrate the effectiveness of Power BI in optimizing inventory management practices, enhancing supply chain efficiency, and driving business growth. Additionally, the study explores the potential implications of Power BI adoption on organizational performance, competitiveness, and customer satisfaction.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

- **Data Collection and Storage Services**

i. *Cloud-based Storage Solutions:* Overview of Azure Blob Storage, Amazon S3, and Google Cloud Storage for storing inventory data securely and cost-effectively.

ii. *Data Integration Services*: Introduction to Azure Data Factory, AWS Data Pipeline, and Google Cloud Dataflow for orchestrating data ingestion and integration processes from diverse sources..

- **Data Processing Services**: Overview of Power BI's data transformation capabilities for cleaning, shaping, and enriching inventory data for analysis. Introduction to Azure Data Lake Analytics, AWS Glue, and Google Cloud Dataprep for scalable data processing and preparation tasks.

- **Machine Learning Services**: Explanation of algorithms and techniques such as regression, time series analysis, and classification for inventory optimization and demand forecasting.

2.2 Tools and Software used

Tools:

Power BI:

Utilize Power BI for creating interactive dashboards and reports to visualize inventory data, monitor key performance indicators (KPIs), and gain actionable insights for decision-making.

Tableau:

Leverage Tableau for visualizing and analyzing inventory data, creating interactive data visualizations, and exploring trends and patterns in supply chain inventories.

Software Requirements:

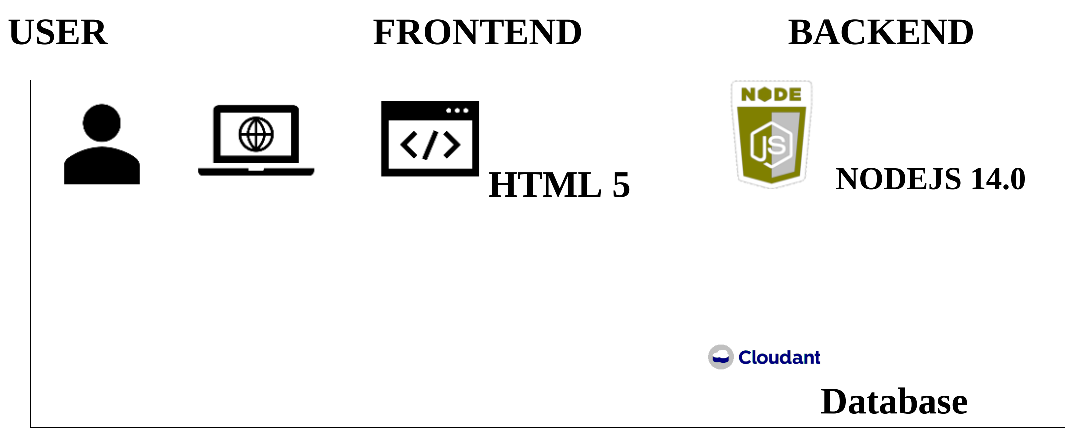
- **PowerBI Service**: This is an online SaaS (Software as a Service) service that you use to publish reports, create new dashboards, and share insights.

- **PowerBI Mobile**: This is a mobile application that you can use to access your reports and dashboards on the go.

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture



Here’s a high-level architecture for the project:

The project architecture delineates the technical blueprint required to conduct supply chain analysis of inventories leveraging Power BI and associated services. It outlines the systematic arrangement of components to facilitate data collection, processing, analysis, and visualization for optimizing inventory management practices within the supply chain.

1. Data Collection and Storage Layer:

Cloud-Based Storage: Utilizes Azure Blob Storage or Amazon S3 to securely store inventory data, ensuring scalability and accessibility.

Structured Data Storage: Stores inventory data in structured formats to enable efficient processing and analysis.

2. Data Processing and Transformation Layer:

Power BI Data Transformation: Utilizes Power BI's capabilities for data cleaning, transformation, and enrichment to ensure data quality and consistency.

Scalable Processing: Employs Azure Data Lake Analytics or AWS Glue for scalable data processing tasks, including cleansing, normalization, and aggregation.

3. Machine Learning and Predictive Analytics Layer:

Predictive Modeling: Integrates Azure Machine Learning or Amazon SageMaker to develop predictive models for forecasting demand patterns and optimizing inventory levels.

Algorithmic Analysis: Applies machine learning algorithms such as regression and time series analysis to identify inventory trends and optimization opportunities.

4. Business Intelligence and Visualization Layer:

Interactive Dashboards: Leverages Power BI for creating interactive dashboards and reports to visualize inventory data, monitor key performance indicators, and derive actionable insights.

User-Friendly Interface: Designs intuitive visualizations and drill-down capabilities within Power BI to enable stakeholders to explore inventory metrics and trends effectively.

Decision Support: Empowers decision-makers with real-time access to inventory analytics, facilitating informed decisions for optimizing inventory levels and supply chain efficiency.

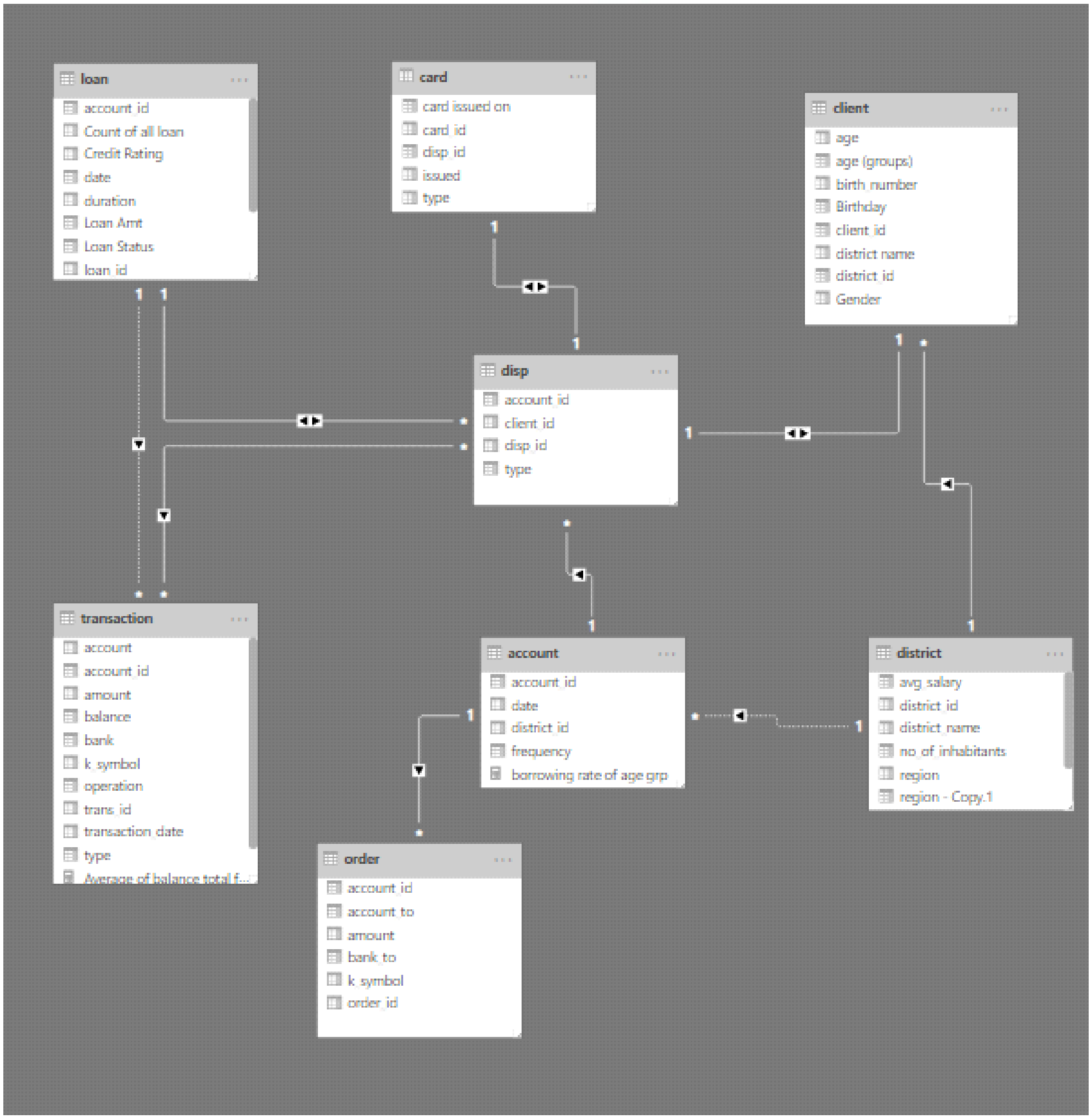
The project architecture delineates a robust framework for conducting supply chain analysis of inventories, leveraging Power BI and complementary services. By orchestrating seamless data flow, processing, and visualization, the architecture empowers organizations to enhance inventory management practices, optimize supply chain operations, and drive business growth.

CHAPTER 4

MODELING AND RESULT

Manage relationship

The “disp” file will be used as the main connector as it contains most key identifier (account id, client id and disp id) which can be use to relates the 8 data files together. The “district” file is use to link the client profile geographically with “district id”


loan
account id
Count of all loan
Credit Rating
date
duration
Loan Amt
Loan Status
loan id
card
card issued on
card id
disp id
issued
type
client
age
age (groups)
birth number
Birthday
client id
district name
district id
Gender
disp
account id
client id
disp id
type
transaction
account
account id
amount
balance
bank
k symbol
operation
trans id
transaction date
type
Average of balance total f...
account
account id
date
district id
frequency
borrowing rate of age grp
district
avg salary
district id
district name
no of inhabitants
region
region - Copy.1
order
account id
account to
amount
bank to
k symbol
order id

Manage relationships

Active	From: Table (Column)	To: Table (Column)
☑	card (disp_id)	disp (disp_id)
☑	client (district_id)	district (district_id)
☑	disp (account_id)	account (account_id)
☑	disp (account_id)	loan (account_id)
☑	disp (client_id)	client (client_id)
☑	order (account_id)	account (account_id)
☑	transaction (account_id)	disp (account_id)
☐	account (district_id)	district (district_id)
☐	transaction (account_id)	loan (account_id)

Edit relationship

Select tables and columns that are related.

card

card_id	disp_id	type	issued	card issued on
1005	9285	classic	931107	Sunday, 7 November 1993
104	588	classic	940119	Wednesday, 19 January 1994
747	4915	classic	940205	Saturday, 5 February 1994

disp

disp_id	client_id	account_id	type
1	1	1	OWNER
2	2	2	OWNER
4	4	3	OWNER

Cardinality: One to one (1:1)

Cross filter direction: Both

- [x] Make this relationship active
- [ ] Apply security filter in both directions
- [ ] Assume referential integrity

Modelling for Gender and Age data

Notice that the Gender and age of the client are missing from the data. These can be formulated from the birth number YYMMDD where at months (the 3rd and

4th digits) greater than 50 means that client is a Female. We can create a column for Gender.

```
Gender =
VAR stringDate = FORMAT(client[birth_number],"General Number")
VAR month = VALUE(MID(stringDate,3,2))
RETURN IF(month > 50,"F","M")
```

client_id	birth_number	district_id	Gender	Birthday	age
3428	875927	42	F	27/09/1987	13
4354	860813	28	M	13/08/1986	14
3417	855318	35	F	18/03/1985	15
10201	851019	13	M	19/10/1985	15
724	855114	46	F	14/01/1985	15

For birthday, we need to reduce the birth month of the female by 50 and then change the date format to DD/MM/YYYY adding 1900 to the year.

```
Birthday =
VAR stringDate = FORMAT(client[birth_number],"General Number")
VAR stringMonth = VALUE(MID(stringDate,3,2))
VAR mth = IF(stringMonth > 50, stringMonth - 50,stringMonth)
VAR year = VALUE(MID(stringDate,1,2))
VAR day = VALUE(MID(stringDate,5,2))
RETURN FORMAT(DATE(year+1900,mth,day),"DD/MM/YYYY")
```

client_id	birth_number	district_id	Gender	Birthday	age
3428	875927	42	F	27/09/1987	13
4354	860813	28	M	13/08/1986	14
3417	855318	35	F	18/03/1985	15
10201	851019	13	M	19/10/1985	15

For Age, we shall assume it is year 1999 as explain previously and use it to minus from the birth year.

```
age = 1999 -RIGHT(client[Birthday],4)
```

client_id	birth_number	district_id	Gender	Birthday	age	age (groups)
2	450204	1	M	04/02/1945	54	36 -54 Baby Boomers

RESULT AND DISCUSSION

A total of 22 items were analysed as shown in Table 2 which are seven items as are categorized in Class A, eight items are categorized in Class B whereas seven items are categorized in Class C. Tonik HerbaGamat (Sea Cucumber), Jeli Pati Gamat (Sea Cucumber), MinyakBelacak (Massage Oil) and Krim Seri Gamat (Cream & Balm) are among the highest by total year revenue which are categorized in Class A. While most of the herbal capsules products are categorized in Class C. Moreover, 1 sea cucumber product, 2 massage oil products, 3 cream & balm products and 2 herbal capsule products which are in medium values of annual sales is kept under a category B.

CASE ANALYSIS AND DISCUSSION

Supply chain strategy and postponement

Placing orders has a cultural aspect: European customers like to plan in advance, even a year ahead, and so they will normally place orders within lead time. Some customers that have long term demands placed orders one year ahead, and then reviewed the actual demand monthly. The non-European customers, on the other hand, including those from America, Australia, Africa, Hong Kong, China, and Taiwan etc., tend not to place long term orders. In other words, the risk of building inventory is high because uncertainty of demand is relatively high. As

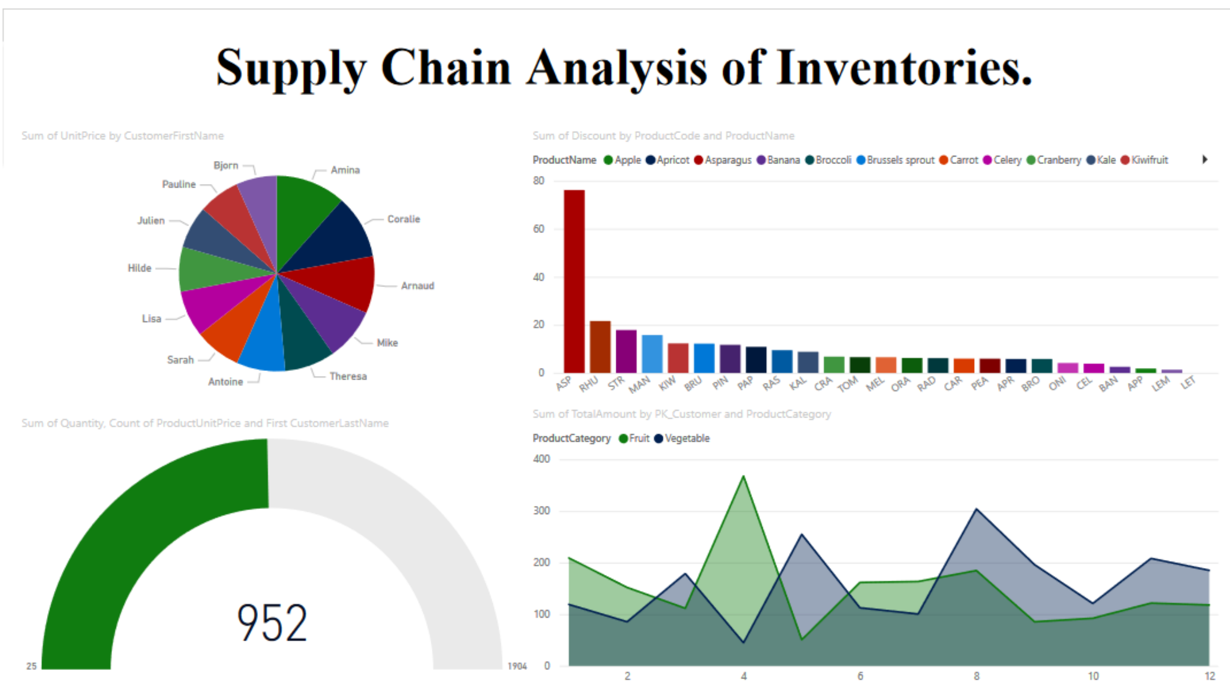
customer demand reflects orders on hand, R&D applies the pull strategy for finished goods.

How to balance the tradeoff between inventory and economies of scale? On one hand, R&D arranges production according to orders on hand. If demand were less than lot size, production would produce the amount of one lot size. If demand were higher than one lot size, production would produce the quantity that meets the customer's requirements. Generally speaking, MRP controllers arrange production according to their experience and historical demand data, but this can hardly define how many items should be kept as safety stock and there are no pre-determined instructions from the management.

The planning for raw materials is based on the demand for semi-finished goods. With the help of SAP, material planners aggregate information on both the finished goods semi-finished goods. However, the high scrap rate and long lead time of production make planning difficult. Moreover, it costs less to purchase huge quantities of raw material abroad via sea freight transportation. Thus, R&D applies a push strategy to arrange the purchase of raw materials. Sometimes stocks of raw material are plentiful, but sometimes, raw materials will be in shortage and this make the production line halt temporary, which wastes both capacity and time. Safety stock is built up but no one knows how much is appropriate and when to build it up.

In sum, we can see that R&D uses three strategies to arrange productions, as illustrated

Dashboard


Supply Chain Analysis of Inventories.
Sum of UnitPrice by CustomerFirstName
Bjorn
Amina
Pauline
Coralie
Julien
Hilde
Arnaud
Lisa
Mike
Sarah
Theresa
Antoine
Sum of Discount by ProductCode and ProductName
ProductName Apple Apricot Asparagus Banana Broccoli Brussels sprout Carrot Celery Cranberry Kale Kiwifruit
80
60
40
20
0
ASP RHU STR MAN KIW BRU PIN PAP RAS KAL CRA TOM MEL ORA RAD CAR PEA APR BRO ONI CEL BAN APP LEM LET
Sum of Quantity, Count of ProductUnitPrice and First CustomerLastName
952
25
1904
Sum of TotalAmount by PK_Customer and ProductCategory
ProductCategory Fruit Vegetable
400
300
200
100
0
2
4
6
8
10
12

CONCLUSION

In conclusion, the supply chain analysis of inventories project presents a comprehensive approach to optimizing inventory management practices within the supply chain. Through the integration of Power BI and associated services, this project offers organizations a powerful toolkit to extract actionable insights from inventory data, enhance decision-making processes, and drive operational efficiency. By leveraging real-time analytics, predictive modeling, and interactive visualizations, stakeholders can gain deeper visibility into inventory trends, mitigate risks, and capitalize on opportunities for improvement. The project architecture provides a structured framework for seamless data collection, processing, and visualization, ensuring data accuracy, scalability, and accessibility. By embracing data-driven decision-making and leveraging advanced analytics techniques, organizations can optimize inventory levels, improve supply chain resilience, and ultimately achieve competitive advantage in today's dynamic business environment. Moving forward, continuous monitoring, iteration, and refinement of inventory management strategies will be essential to adapt to evolving market conditions and sustain long-term success. Overall, the supply chain analysis of inventories project signifies a transformative journey towards agile, data-driven supply chain management practices that enable organizations to thrive in an increasingly complex and competitive landscape.

FUTURE SCOPE

The future scope for the supply chain analysis of inventories project is vast and promising, with opportunities for further enhancements and expansions to drive greater value and impact. One avenue for future exploration involves the integration of emerging technologies such as blockchain and Internet of Things (IoT) devices to enhance supply chain visibility and traceability, enabling real-time tracking of inventory movements and reducing the risk of counterfeit products. Additionally, there is potential to incorporate advanced analytics techniques such as prescriptive analytics to not only predict inventory trends but also recommend optimal inventory management strategies in dynamic and uncertain environments. Furthermore, the project could extend its scope to encompass sustainability considerations by analyzing the environmental impact of inventory management practices and identifying opportunities for reducing waste and carbon emissions throughout the supply chain. Collaboration with industry partners and academia could also facilitate the development of benchmarking tools and best practices frameworks to enable organizations to benchmark their inventory management performance against industry standards and peers. Finally, with the advent of artificial intelligence and machine learning advancements, there is immense potential to automate decision-making processes, optimize inventory replenishment algorithms, and further improve supply chain resilience and agility. In essence, the future scope for the supply chain analysis of inventories project is characterized by continuous innovation, collaboration, and adaptation to leverage emerging technologies and address evolving market dynamics and customer expectations.

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