

Influence of Demand Forecasting in reducing the percentage of Safety Inventory of a Company's Supply Chain to generate higher efficiency

By

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List of Acronyms

ATO - Assembled to Order

ATP - Available to Promise

BOM - Bill of Materials

CBP - Consensus Business Planning

CIRM-Certified in Integrated Resources Management-CIRM is a comprehensive educational program designed to help you understand the power of collaboration among organizational resources such as product development, marketing/sales, human resources, finance, and operations.

CPFR - Collaborative, Planning, Forecasting and Replenishment is a concept popularized and institutionalized by the VICS organization to enable manufacturers and retailers to better collaborate on forecasting and promotional planning to achieve supply chain efficiencies.

CPG - Consumer Packaged Goods, refers to the manufacturers and supplies in the Packaged Goods industry, a very specific reference to companies that manufacture or distribute Consumer Packaged Goods to the retail environment.

CFPIM-Certified Fellow in Production and Inventory Management

CPIM - Certified in Production and Inventory Management, a certification offered by the APICS, the Association for Operations Management.

CRM - Customer Relationship Management; the process and discipline to analyze the trade funds, promotional planning and execution and evaluating the effectiveness of promotions. Oracle CRM, Siebel, and SAP CRM are the dominant players in this space. Siebel and Demantra have been acquired by Oracle.

CRP - Continuous Replenishment Program, another term to denote VMI or Vendor Managed Inventories, where the supplier or manufacturer monitors the inventory at the customer warehouse on a continuous basis and writes the orders on behalf of the customer to ensure warehouses are adequately stocked.

CSCP - Certified Supply-Chain Professional

CTO - Configured to Order

DC - Distribution Center

DP - Demand Planning, a functional and subject reference to the forecasting group and role

DDSN -Demand Driven Supply Networks

DRP - Distribution Requirements Planning

DTC - Direct To Channel

EDI - Electronic Data Interchange

EOQ - Economic Order Quantity

ETO - Engineered to Order

FAN - Flu Alert Network

FG - Finished Goods

FMCG - Fast Moving Consumer Goods

FSI - Free Standing Insert, AKA "Coupon"

IBM - Integrated Business Planning

IBP - Integrated Business Planning

IO - Inventory Optimization

JIT - Just In Time

KPI - Key Performance Indicator

LTL - Less than Truck Load

MAPE - Mean Absolute Percent Error a cross-sectional measure to calculate the demand forecast error across products, customers, divisions etc.

MAD - Mean Absolute Deviation, similar to MAPE before it becomes a percentage error. Academics respect this measure, largely due to confusion and mis-interpretations around the MAPE.

MRP - Materials Requirements Planning

MTD - Month to date

MTG - Month to Go

MTO - Made to Order, a type of production and inventory strategy that starts the manufacturing process only on receipt of the customer order. The manufacturer has the luxury of making the customer order, (and perhaps pay) and wait. Dell is a classic example of a MTO business model.

MTS - Made to Stock, a production and replenishment model that keeps inventory of products, anticipating customer orders.

OFS - Oil Field Services

OLS - Ordinary Least Squares, the most basic methodology for model fitting by choosing the model that minimizes the residual error.

OTC - Over The Counter

PMAD - Percent Mean Absolut

POS - Point of Sale

POP - Point of Purchase

RMSE - Root Mean Squared Error, a measure of model diagnostic and with more application in inventory management to set parameters for safety stock calculations.

SCOR - Supply Chain Operations Reference Model

S&OP -Sales and Operations Planning

SIOP -Sales, Inventory and Operations Planning

SKU - Stock Keeping Unit

SNP -Supply Network Planning

SMI -Supplier Managed Inventory, very similar to VMI except here the manufacturer lets their inventories be managed by a supplier of key components and input products.

VMI -Vendor Managed Inventories, where the supplier or manufacturer monitors the inventory at the customer warehouse on a continuous basis and writes the orders on behalf of the customer to ensure warehouses are adequately stocked.

WIP - Work in Process

WAPE - Weighted Absolute Percent Error - The same as weighted MAPE

Abstract

In this research, we discuss the definition of Demand Forecasting and Safety Inventory and synthesize both to get the impact of their relation for having a higher efficiency. We look at the overlap between demand forecasting and safety inventory and the interdependence of the two. We also discuss the historical development of this topics. We look at the various forecasting methods and provides the best one. We then understand the impact of safety inventory and how it influences the overall in fluency of a company. We take a brief journey through various forecasting thoughts and their influence on our understanding of management. Lastly, we use the knowledge generated from the study for giving the company an optimized inventory management solution, which will eventually contribute in generating higher efficiency and effectiveness as well.

Chapter 1: Introduction

These two closely-related subjects contain the solutions to many expensive problems encountered by manufacturers and distributors—problems that executives, managers, and practitioners often believe have no solution. But forecasting and inventory planning are a science, not an art, and a little knowledge of this science can pay big dividends in terms of improved service and reduced inventory and expediting. Without this knowledge, executives and managers cannot hope to guide their people to achieve superior results. The good news is: one does not need to be a statistician or an engineer to understand the general principles of this science. This presentation provides an overview of the concepts and relationships, linking them to typical operational problems and reviewing solution alternatives. We all know what Demand Forecasting is but bear in mind that Inventory Planning means figuring out what your inventory should be (not counting what you have). This is an Executive Briefing. That means we will stay at a high conceptual level with almost no formulas.

However, given that this is largely an APICS audience, I have included a few more details than typical for an executive briefing. E/Step Software Inc. works with companies that have concerns about their:

1. Forecast accuracy
2. Inventory levels
3. Customer service levels
4. Expediting levels
5. Forecast/inventory analyst productivity

So we educate our clients in the science of demand forecasting & inventory planning and provide them with the tools to raise forecast accuracy and service levels while cutting inventory, expediting, and the analysts time required.

1.1 Purposes of Forecasting:

1.1.1 Purposes of Short-Term Forecasting

- Appropriate production scheduling.
- Reducing costs of purchasing raw materials.
- Determining appropriate price policy
- Setting sales targets and establishing controls and incentives.
- Evolving a suitable advertising and promotional campaign.
- Forecasting short term financial requirements.

1.1.2 Purposes of Long-Term Forecasting

- Planning of a new unit or expansion of an existing unit.
- Planning long term financial requirements.
- Planning man-power requirements.

1.2 Length of Forecasts:

Short-term forecasts - up to 12 months, e.g., sales quotas, inventory control, production schedules, planning cash flows, budgeting.

Medium-term - 1-2 years, e.g., rate of maintenance, schedule of operations, and budgetary control over expenses.

Long-term - 3-10 years, e.g., capital expenditures, personnel requirements, financial requirements, raw material requirements (Most uncertain in nature)

1.3 Control Demand or Management of Demand:

The key to management of demand is the effective management of the purchases of final consumers.

The management of demand consists in devising a sales strategy for a particular product. It also consists in planning a product, or features of a product, around which a sales strategy can be built. Product design, model change, packaging and even performance reflect the need to provide what are called strong selling points.

1.4 Independent v/s Dependent Demand

Another way to understand inventory is to separate it into two broad categories: dependent and independent demand. Understanding this difference is important as the entire inventory policy for an item is based on this. Independent demand is *demand for a finished product*, such as a computer, a bicycle, or a pizza. Dependent demand, on the other hand, is *demand for component parts or subassemblies*. For example, this would be the microchips in the computer, the wheels on the bicycle, or the cheese on the pizza.

The two inventory systems we discussed are used to determine order quantities for independent demand. But how do we compute quantities for dependent demand? Quantities for dependent demand are *derived* from independent demand, which we call the “parent.” For example, we can forecast the amount of automobiles we expect to sell, then we can derive the quantities needed of wheels, tires, braking systems, and other component parts. For example, if a company plans to produce 200 cars in a day, it would need 800 wheels, 400 windshield wipers, and 200 braking systems. The number of wheels, windshield wipers, braking systems, and other component parts is dependent upon the quantity of the independent demand item from which it is derived.

1.5 Forecasting Techniques:

Understanding that the forecast is very often inaccurate does not mean that nothing can be done to improve the forecast. Both quantitative and qualitative forecast can be improved by seeking inputs from trading partners. Qualitative forecasting methods are based on opinions and intuition whereas quantitative forecasting methods use mathematical models and relevant historical data to generate forecast.

Qualitative Methods:

The qualitative methods are subdivided into. The four common qualitative forecasting models are,

Jury of Executive Opinion:

Qualitative forecasting in which a group of senior management executives who are knowledgeable about the market, competitors, and the business environment collectively developed the forecast.

Delphi Method:

Qualitative forecasting in which a group of internal and external experts are surveyed during several rounds in term of future events and long term forecasts of demand; the group members do not physically meet.

Sales Force Composite:

Qualitative forecast generated based on the sales force's knowledge of the market and estimates of the customers need.

Consumer Survey:

A questioner administered through telephone, mail, internet, or personal interviews that seeks inputs from customers on important issues such as future buying habits, new product ideas, and opinions about existing products. (Wisner, Tan, & Leong, 2008)

Quantitative Methods:

Time series forecasting is based on the assumptions that the future is an extension of the past, thus, the historical that can be used to predict future demands.

The components of time series data are,

Trend Variations:

Either increasing or decreasing ,movements over many years that are due to factors such as population growth, population shifts, cultural changes, and income shifts.

Cyclical Variations:

Wave like movements that are longer than a year and influenced by macroeconomic and political factors.

Seasonal Variations:

Peaks and valleys that repeat over a constant interval such as hours ,days, weeks, months, years, or seasons.

Random Variations:

Random peaks and valleys those are due to unexpected or unpredictable events such as natural disasters (hurricanes, tornadoes, fire) strikes, and wars.

(Wisner, Tan, & Leong, 2008)

1.6 Collaborative Planning, Forecasting and Replenishment (CPFR):

Voluntary Inter industry Commerce Standards (VICS), a New Jersey based Association defines Collaborative Planning, Forecasting and Replenishment (CPFR) as, "a business practice that combines the brainpower of two or more trading partners in planning the ways to fulfill the customer demand." They also explained the relationship that CPFR links best practices of sales and marketing, such as category management, to the implementation of supply chain planning and completion process, "to increase availability while reducing inventory, transportation and logistics costs."

Basically CPFR is an approach that deals with the requirements for good demand management. The most involved industries with CPFR are consumer products and food and beverage. (Collaborative Planning, Forecasting & Replenishment CPFR)

1.6.1 Objective of CPFR:

The objective of CPFR is to "optimize" the supply chain process by:

- Improving accuracy of forecasting demand
- Delivering the right product at the right time to the right location
- Reducing inventory
- Avoiding stock outs
- Improving customer service

But the most important fact on which the achievement of objective and activities of CPFR depend is to have collaborative trading partners who share risk and information mutually in the whole process.

Without Collaborative planning and forecasting between the trading partners will make the supply chain "suboptimal", thus will result in less-than-maximum supply chain profits. (Wisner, Tan, & Leong, 2008)

1.6.2 Real value of CPFR:

It is observed that forecasting developed only by firm tends to be inaccurate most of the time so therefore in CPFR when both the buyer and seller collaborate in forecasting, then it makes possible to match buyer needs with supplier production plans, thus ensuring competent replenishment. CPFR also helps in avoiding expensive corrections after the fact when demand or promotions have changed. (Wisner, Tan, & Leong, 2008)

1.6.3 Benefits of CPFR:

- Strengthens supply chain partner relationships
- Provides analysis of sales and order forecast which improves the forecast accuracy
- Manage the demand chain and proactively eliminate problems before they appear
- Allow collaboration on future requirements and plans
- Combine planning, forecasting and logistic activities.

1.6.4 Challenges for CPFR implementation

There are top three difficulties faced by organizations in implementing CPFR:

- Making internal changes:

Internal changes must always be tackled by top management as change is always difficult but if the top management is dedicated to the project and in educating employees about the benefits of CPFR then there are more chances of getting a successful internal change.

- Total implementation cost:

Although cost is an important factor to be considered always but companies must determine whether they are at a competitive disadvantage.

Trust: is one of the biggest hurdles in general implementation of CPFR as many retailers are unwilling to share the information required to implement CPFR. For example: Wal-Mart may be willing to share their sensitive data with the Wal-Mart only as they do not want other suppliers to know their information.

1.7 Safety Inventory:

Manufacturing companies rely on forecasting to project demand to schedule production. Production rates are compared to projected sales rates to determine the impact of projected sales on inventory. Inventory levels rise if production exceeds sales and falls if sales exceed production. In that high inventory levels negatively impact cash flow and warehousing capacity, and sharp decreases in sales can lead to obsolete inventory, it is important to balance production rates and inventory with sales volumes. However, it is equally important that sufficient inventory be available to meet demand and avoid backorder situations.

1.7.1 Overstock

A risk exists in terms of cash flow, sales prices and warehousing capacity in the event that manufacturing capacity is insufficiently flexible to mirror actual demand, but rather manufactures products at a steady rate to accommodate increasing sales, which is greater than demand. In this instance, if the increase in sales does not materialize as anticipated, or materializes but at a lesser rate than the production rate, excess inventory results, which negatively affects cash flow. In addition, excess inventory can lead to drastic reductions in prices to encourage the purchase of the inventory and thereby avoid stocking obsolete products.

1.7.2 Understock

A risk also exists in terms of cash flow, sales and customer retention in the event that manufacturing capacity does not mirror actual demand, but rather manufactures products at a steady rate to accommodate increasing sales, which is less than demand. In this instance, the increase in sales materializes at a rate greater than anticipated, or at a rate greater than the production rate, and insufficient levels of inventory negatively affect cash flow. In addition, insufficient inventory can lead to a drastic reduction in prices to encourage the return of

customers who did not tolerate a backorder situation and instead became customers of another company.

1.8 THE RELATIONSHIP BETWEEN INVENTORY MANAGEMENT AND SUPPLY CHAIN MANAGEMENT

Supply chain is a process which all of us should be aware of since this process plays an important role in the success of an organization. However, the success of an entity still depends on how they would work on having an appropriate design of their supply chain that depends on both the customer's needs and the roles played by the stages involved. On the other hand, inventory, which determines the success of the firm, has a big role in the supply chain since it is one of its performance drivers. It is important to know how inventory management is connected or related to supply chain to be able to come up with a strategy that would definitely contribute to the success of a firm. In this blog, I will be discussing the relationship of the two especially how inventory management plays a big part in order for the supply chain to work.

First of all, inventory contains the raw materials, the work in process and all the finished products of a supply chain. By that, any changes in the inventory policies would definitely affect the supply chain's efficiency and responsiveness. Inventory, being one of the drivers of supply chain performance, need to coordinate with other drivers to be able to determine the responsiveness and efficiency of the supply chain's performance. With that, we can see that inventory management is one of the important aspects of determining if and how strategic fit is achieved across the supply chain by its structure. Supply chain would not be efficient and responsive if inventory was not managed properly.

It is said that inventory management is transporting materials from raw materials to the ultimate consumer, managing the movement and flow through the supply chain. It is through the supply chain that we can be able to manage the movement and flow of the inventory. By that, we can already see the relationship of both the supply chain and the inventory with each other. Without inventory management, there would be no supply chain process. Each process should be managed according to the fulfilment of the ultimate priority which is the consumer satisfaction. The relationship of the inventory with supply chain is to be able to know the time it takes for a product to flow through the “pipeline” to the end consumer. In short, supply chain carries inventory to meet uncertainties and mismatch regarding demand and supply. Good management of the supply chain is achieved by integrating the logistics business processes of the partners in a supply chain to ensure the coordinated flow and storage as this would be carried out in the functional area of inventory management as well.

I can say that inventory is the main part of any supply chain of a firm that plays an important role in the supply chain decisions. Since it serves to have a vital role in the supply chain, managing inventories efficiently would always be challenging for the supply chain managers. In order to have an effective management of the inventory for the supply chain, managers should be able to have effective strategy. Managers should be able to go through the supply chain decision phases that is made to raise the supply chain surplus. However, these decisions are associated with uncertainties. One of these phases is the supply chain planning that would be able to forecast inventory demand in different markets that includes what inventory policies are to be followed. With this, I can say that in this phase, firms are able to manage inventory in the supply chain by forecasting the uncertainties of demand. If firms would be able to determine or forecast demands, then inventory management would take place in the supply chain. Inventory also has a significant role on having an effective competitive strategy in a supply chain. Having large amounts of inventory or having less inventory would affect the responsiveness of a supply chain. This is how inventory takes place on the competitive strategy of a firm in a supply chain.

In conclusion, effective supply chain management can be done by having an effective inventory management. The two should be coordinated with each other especially in monitoring the flow of inventory in the supply chain. Any changes with the inventory policies would always have an impact on the supply chain that's why inventory management and supply chain management processes should be integrated that would result to the success of a firm if implemented efficiently and effectively. Also, it is important that managers should always consider actions lowering the amount of inventory needed avoiding cost to increase neither reduce the responsiveness of the supply chain. If inventory is managed efficiently then there would probably a good management of supply chain as well. They are interconnected with each other and if one of them does not coordinate with the other, then it would surely result to the failure of a firm to satisfy customer's expectations and needs, thus affecting firm's profitability.

Chapter 2: Relation between Demand Forecasting and Supply Inventory

All demand forecasts are done to make material flow effective with the least costs/resources and with the maximum "margin generated" on sold items.

The type of procedures used in demand forecasting (quantitative or qualitative), depends not only on historic sales data themselves, but also tasks given and resources and information systems available.

In this part we consider the interaction of forecasting procedures with levels of management decisions covering the plan-graph based demand, sales and the operation planning ordering environment. Also qualitative collaborative forecasting procedure for supply chain management can be considered.

The general principle is that the nature of the forecast must be matched with the nature of the decision. Hence, various factors influence the form of forecasting system such as:

- variety of sources
- levels of aggregation
- assumptions about the market
- level of management involvement
- nature of the techniques used
- frequency of forecasts
- availability of past data
- budget, legislation, goal or other restrictions
- competitors' actions and new product introductions
- information from clients
- economic changes, special promotions, product, technology changes

Let us consider the nature of decisions at different levels.

2.1 Forecasting for Strategic Business Planning

Forecasts here are highly aggregated estimates of general business trends over the long term. The forecasts are usually stated in very general terms (such as total sales dollars or some output measure such as total tons, board feet, or engineering hours). Substantial managerial judgment is therefore required in preparing and reviewing such forecasts. Causal models and the statistical tools of regression and correlation analysis can be also used.

There are a variety of strategic decisions:

- constructing a new plant
- developing more supplier capacity
- expanding internationally
- capital-expansion projects
- proposals to develop a new product line
- merger or acquisition opportunities

2.2 Forecasting for Sales and Operations Planning

This type of forecasting provides the basis for plans that are usually stated in terms of planned sales and the associated output of product families (in dollars or some other aggregate measure). The plans extend forward for a few months up to a year for each of the product lines they cover.

One important input into the forecasts for S&OP is data on customer plans and current demand from sales and marketing and additionally, from communication with customers.

Chapter 3 : Our Field of Research

3.1 Company Overview

In 1971 the young Bangladesh Republic was starting to build itself from the ground up after the turmoil of the Liberation War. Despite its great economic difficulties, Bangladesh began to flourish in many areas, especially the textile domain. It was for the growing domestic demand for sewing thread that Mr. Abdus Salam and late Prof. Nurul Bari Chowdhury founded the Bangladesh Textile Industries (BTI) in a small workshop in Chittagong. This was the birth of today's Well Group, now a leading industrial group in Bangladesh.

Since our humble beginnings just over two decades ago, Mr. Abdus Salam has managed to nurture this company at a steady pace. Twenty years after its foundation in 1973, BTI moved to its present location in the BSCIC Industrial Estate, Kalurghat, Chittagong, under the banner of Well Group. It was here that the foundation was laid for our modern and integrated production facilities for industrial sewing and embroidery thread (spinning, twisting, dyeing and finishing), dyed yarn and ready-made garments -- all under one complex, which hosts an 8MW in-house power generation facility, ensuring an uninterrupted production process.

Today Well Group employs over 18,000 people in its integrated production units, operating in an indoor facility spanning over 10,00,000 sqft.

Well Group is not only dedicated in its efforts in the textile sector but has also spread its wings into the Food, Hotel and Real Estate sectors in the recent past. Today, Well Group has fourteen production facilities that include a food court and a 3-star hotel among others, with a combined annual turnover of US\$ 100 million.



Figure 1 : Logo of Well Food

- Well Group operate the largest food chain in Chittagong under the banner of Well Food. Our mission is to provide global quality food in a very hospitable environment. Entertaining our customers in a very friendly atmosphere with efficient service is the key to our success.
- They represent Baskin-Robbins, one of the worldwide market leaders and the home of delicious and innovative ice cream treats. In addition to the usual collection of ice cream, Baskin-Robbins features a delicious selection of frozen drinks.
- Sugar Bun has become one of the leading and most innovative Quick Service Restaurants. Not limiting themselves to broasted chicken and hamburgers Sugar Bun has stepped forward to offer mouth-watering Asian Cuisine, Patisseries, Café Bar Beverages and Western Cuisine to a great variety of taste.
- Well Group signed franchise agreement with Indian legend Beverage brand ‘Campa’ for producing and marketing their cola, lime and orange in Bangladesh.



Figure 2 : Logo of Well Group

Chapter 4 : Methodology

We have divided our whole research work methodology in some segments. We had dedicated separate timeline for each performance and feedback and further modifications or change of plans if needed.

The following Gantt chart shows our work methodology timeline:

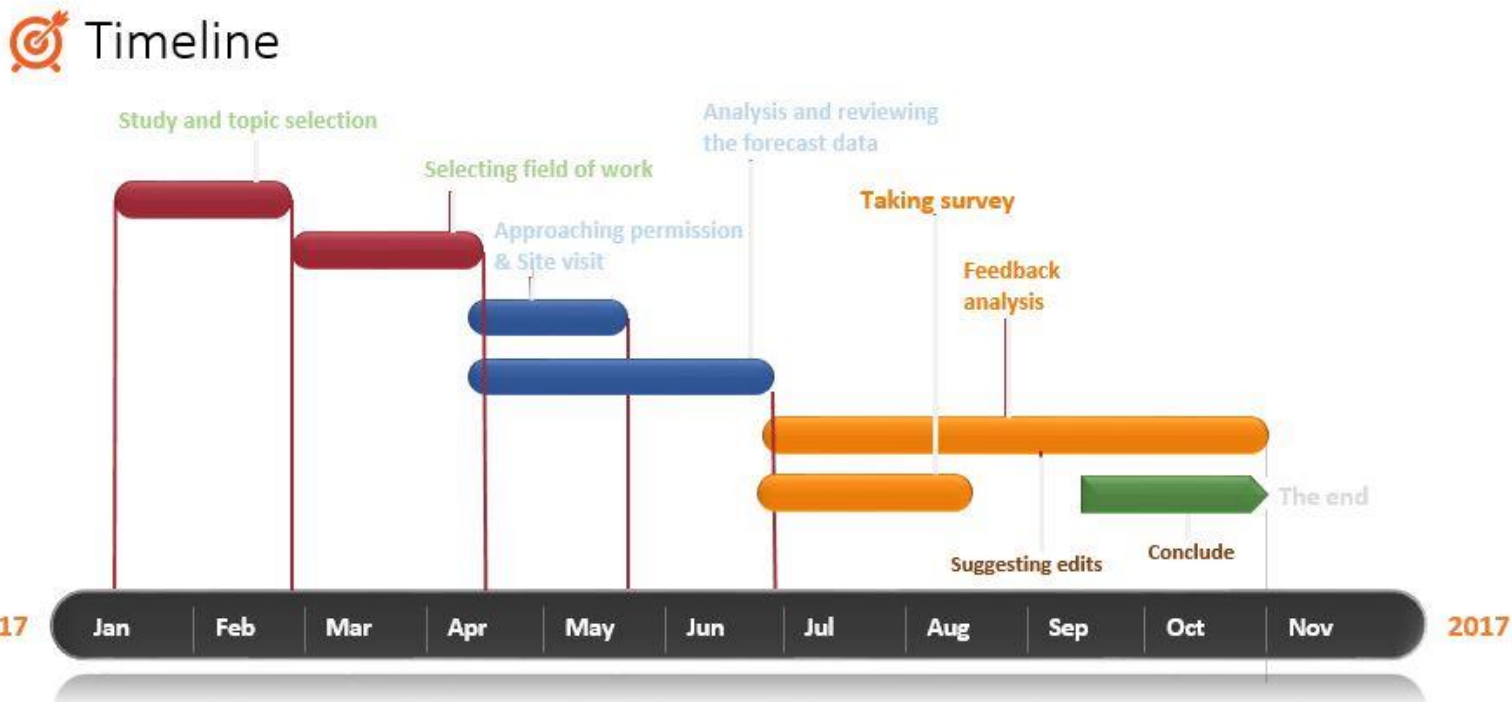


Figure 3 : Gantt Chart

Objectives of our study:

- To determine influence of demand forecasting.
- Reduction of safety inventory.
- Generate higher efficiency.

Importance of our study:

- To hold a better impact on the supply chain on the company.
- To ensure lesser cost and expenditure for greater revenue generation.
- To acquire an exact idea of the customer demand
- To generate higher efficiency

Chapter 4 : Research Framework

After going through the company profile and analyzing the obtained data. We proposed them some ideas for having an organized and updated target group which will have positive impact on getting more accurate data.

4.1 Online Survey

We have performed an online survey for them, under their banner on their facebook fan page.



Figure 4 : Media Promotion (Facebook)

The survey duration was 2 months.

And we got 378 responses in total!

The survey reports are as followed:

4.2 Survey Reports:

Age

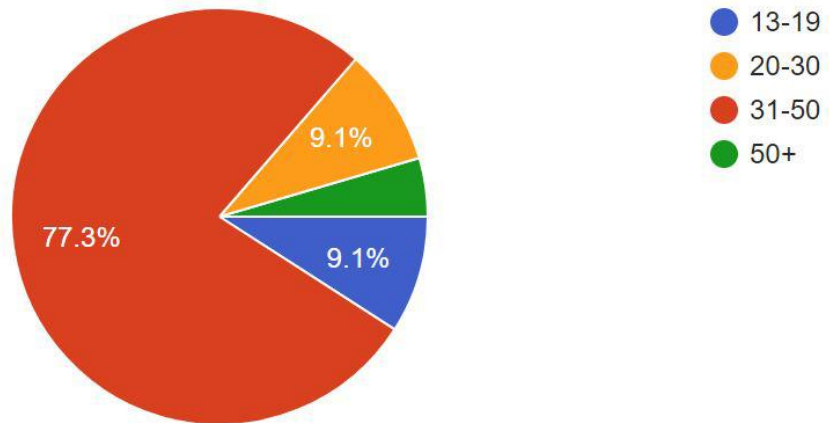


Figure 6 : Pie Chart (Year wise)

Your occupation

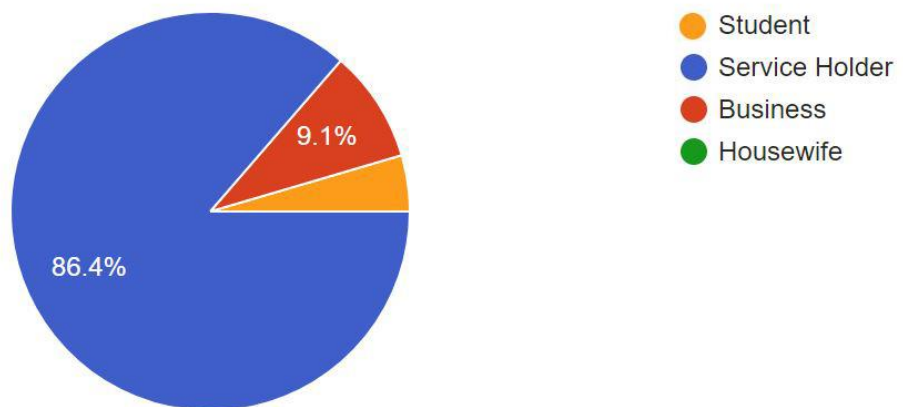


Figure 5 : Pie chart (Occupation wise)

How regularly do you visit well food?

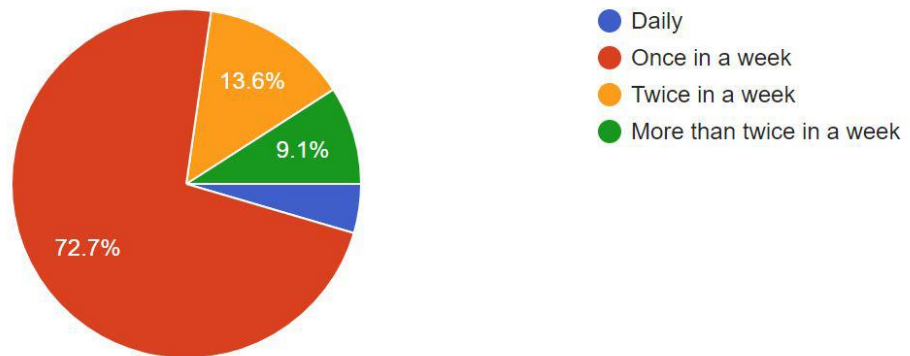


Figure 7 : Pie chart (Visiting wise)

Which types of items do you buy?

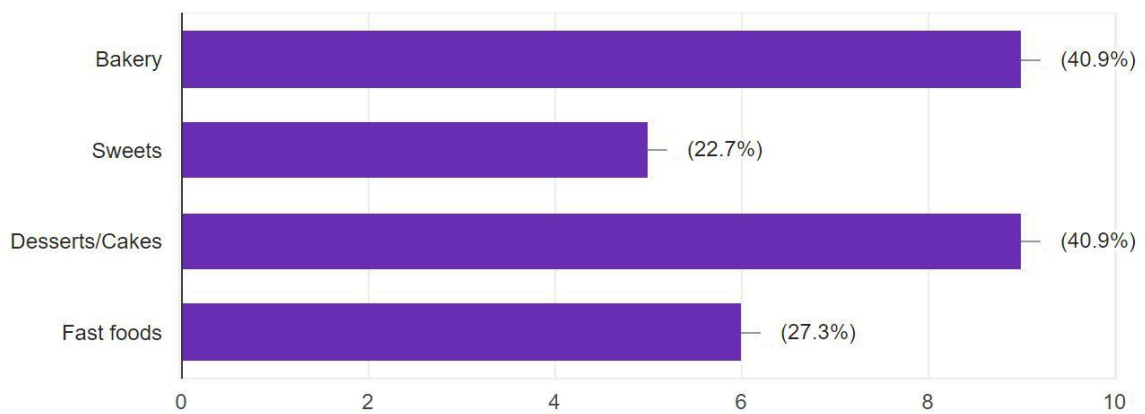


Figure 8 : Bar Chart

Would you like to have a membership card for better customer service and discounts?

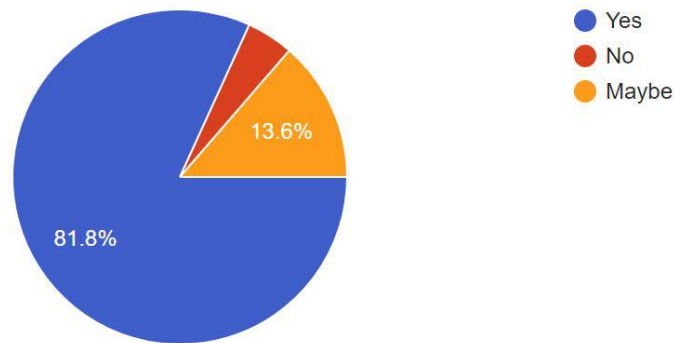


Figure 9 : Pie Chart (Choice wise)

4.3 Outcome of the survey:

- More accurate demand forecasting.
- Lesser amount of inventory.

4.4 Idea of issuing membership card

For a greater hold on forecasting, we have proposed them with an idea of issuing a digitally readable Membership Card. With the help of this, they can track the purchase order of their premium customers.

Which will eventually result in more accurate forecast and an optimized inventory as well.

Sample Design of the Membership Card:



Figure 10 : Sample of proposed membership card

Impact of member ship card

- Good impact on the customers
- Better idea about regular customers
- Better Forecasting
- Strong online database

4.5 Calculation

Twelve methods of calculating forecasts are available. Most of these methods provide for limited user control. For example, the weight placed on recent historical data or the date range of historical data used in the calculations might be specified. The following examples show the calculation procedure for each of the available forecasting methods, given an identical set of historical data.

The Twelve methods are

- "Method 1 - Specified Percent Over Last Year,"
- Method 2 - Calculated Percent Over Last Year,"

- "Method 3 - Last year to This Year,"
- "Method 4 - Moving Average, "Section A.7, "Method 5 - Linear Approximation,"
- "Method 5 - Linear Approximation,"
- "Method 6 - Least Square Regression,"
- "Method 7 - Second Degree Approximation,"
- "Method 8 - Flexible Method,"
- "Method 9 - Weighted Moving Average,"
- "Method 10 - Linear Smoothing,"
- "Method 11 - Exponential Smoothing,"
- "Method 12 - Exponential Smoothing with Trend and Seasonality,"

Our calculations:

Table 1 : Estimated Trend (according to year)

Year	Sales y	1990 = 0 Time- Deviation x	x^2	xy	Estimated Trend'000 $Y=45 + 5x$
2013	45	1	1	45	50
2014	56	2	4	112	55
2015	78	3	9	234	60
2016	46	4	16	184	65
2017	75	5	25	375	70

$$n = 5 \quad \Sigma y = 300 \quad \Sigma x = 15 \quad \Sigma x^2 = 55 \quad \Sigma xy = 950$$

Table 2 : Final estimated trend

$$n = 5 \quad \Sigma y = 300 \quad \Sigma x = 15 \quad \Sigma x^2 = 55 \quad \Sigma xy = 950$$

$\Sigma y = n.a. + b \Sigma x \quad \dots 1$ $\Sigma xy = a \Sigma x + b \Sigma x^2 \quad \dots 2$ <p>Substituting the computed values we have,</p> $300 = 5a + 15b \quad \dots 3 \quad (x \ 3)$ $950 = 15a + 55b \quad \dots 4$ <p>Multiplying (3) by 3 we have</p> $900 = 15a + 45b$ $950 = 15a + 55b$ <p>Therefore, $10b = 50, \quad b = 5$</p> <p>Substituting $b = 5$ in (3)</p> $300 = 5a + 15(5)$ $300 = 5a + 75$ $5a = 225 \quad \quad \quad a = 45$	<p><i>St. line equation is $Y = a + bx$</i></p> <p><i>Substituting the values of a and b,</i></p> $Y = 45 + 5x$ <p><i>Therefore,</i></p> $(x=1) = 45 + 5(1) = 50$ $(x=2) = 45 + 5(2) = 55$ $(x=3) = 45 + 5(3) = 60$ $(x=4) = 45 + 5(4) = 65$ $(x=5) = 45 + 5(5) = 70$ $(x=6) = 45 + 5(6) = 75$ <p>Forecast for the year 2019</p> $(x=7) = 45 + 5(7) = 80$ <p style="text-align: right;">i.e. BDT: 8,00,00,000/-</p>
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Table 3 : Simulated Forecast

Month	2015 Sales	2016 Sales	2017 Sales	Simulated 2016 Forecast
January	125	128	120	
February	132	117	110	
March	115	115	108	
April	137	125	117	
May	122	122	114	
June	130	137	128	
July	141	129	121	
August	128	140	131	
September	118	131	123	
October	123	114	107	127.13178
November	139	119	111	143.66925
December	133	137	128	137.4677

Forecast Calculation

Range of sales history to use in calculating growth factor (processing option 2a) = 3 in this example.

Sum the final three months of **2016** : $114 + 119 + 137 = 370$

Sum the same three months for the previous year: $123 + 139 + 133 = 395$

The calculated factor = $370/395 = 0.9367$

Calculate the forecasts:

January, **2016** sales = $128 * 0.9367 = 119.8036$ or about 120

February, **2016** sales = $117 * 0.9367 = 109.5939$ or about 110

March, **2016** sales = $115 * 0.9367 = 107.7205$ or about 108

All these calculations show the difference of the previous and current forecast and improvements so far. The result is not complete because Well Group will conduct the next audit and forecast survey on December.

After that data we may get the actual difference of the modified forecast and conventional forecast.

Outcome of the forecast calculations:

- Better result in forecasting
- Improved hold on the EOQ (Economic Order Quantity)

Chapter 5 : Impediments

Problems Faced

In order to carry out our study we needed a wide ranges of data. Most of them were classified as restricted due to company policy. Moreover our study is based on a single urban based location only. The main problem was to deal with the variable ranges of products. As the mother company deals with huge number and widespread range of products, shaping them into a single profile and forecasting a demand was tough.

Our study is mainly based on demand forecasting due to limited time frame. In order to determine the EOQ the safety inventory needs to be known but required data are not accessible yet.

- Lack of organized data.
- Study based on limited area.
- Restricted access.
- Variable range of product
- No customer feedback system.
- Restricted access.

Chapter 6 : Conclusion

Studying the various aspects of proper forecasting and an optimized inventory, it is obvious that it contributes to overall effectiveness of the company.

Although forecasting itself is an uncertainty, but the closer we get to the actual value, the accurate we are.

Forecasting being one of the core drivers of any company's Supply Chain Management, a proper forecasting can do wonders and take the company to a better place both in revenue generation and as well as customer satisfaction.

This research of ours is focused on this goal, to improve the SCM of the company through better forecasting and optimum inventory, so that the company can shine brighter.

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