A PROJECT REPORT ON
"USE OF FORECASTING FOR INVENTORY MANAGEMENT IN SUBHAMS GEAR, KHAIRNE"

Submitted By

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In Partial Fulfillment for the Award of Degree
Of

BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING

UNDER THE GUIDANCE
DR. MOHD. ASIF GANDHI

DEPARTMENT OF MECHANICAL ENGINEERING
ANJUMAN-I-ISLAM' S
KALSEKAR TECHNICAL CAMPUS, NEW PANVEL
NAVI MUMBAI – 410206

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CERTIFICATE

This is to certify that the project entitled

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To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by **University Of Mumbai**, is approved.

Internal Examiner **External Examiner**

Prof. - _____ Prof. - _____

Head of Department **Principal**

Prof. _____ Dr. _____

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APPROVAL OF DISSERTATION

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(Internal Examiner) **(External Examiner)**

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Date:_____

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It is the incidence of great pleasure in submitting this project synopsis. We take this opportunity to express our sincere gratitude to our guide **DR. MOHD. ASIF GANDHI** for his valuable guidance in this undertaking, without which the project report would not have been completed .We are very much grateful to him for his untiring assistance in this project and he has been encouraging us in eliminating the errors. The project has been developed as a result of valuable advice.

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I take this opportunity to give sincere thanks to **Mr. JAVED SHAIKH**, Owner in "*SUBHAMS GEAR"*, for all the help rendered during the course of this work and their support, motivation, guidance and appreciation.

Last but not the least I would also like to thank all the staff of **Kalsekar Technical Campus** (Mechanical Engineering department) for their valuable guidance with their valuable guidance with their interest and valuable suggestion brightened us.

WHAT DOES THE PROJECT REALY MEAN?

DEFINATION OF PROJECT:-

P ⟹ planning before carrying out the work

R ⟹ RAW material required for the work

O ⟹ organization of the work

J ⟹ **j**oint effort put in to the work

E ⟹ Estimation of material required in the work

C ⟹ Costing of the work

T ⟹ Techniques used in performance

ABSTRACT

This synopsis discusses the "**SALES FORECASTING IN SUBHAM GEAR". Sales Forecasting** is the process of estimating future **sales.** Accurate forecasting enables companies to make informed business decision and predict short term and long term performance. Companies can base their **forecasts** on past **sales** data, industry-wide comparisons, and economic trends. Forecasting techniques are used for making relatively short term decisions in this is Quantitative Method. The quantitative method is further divided into Time series analysis method. However the time series analysis method is further classified into **Moving Average Method**, **Exponential Smoothing Method, Least Square Method, etc.** For sales forecasting three methods are used i.e. Moving Average Method, Exponential Smoothing Method, Least Square Method to forecast for the year 2019 by using previous data from 2018 to 2019.In order to ensure the accuracy of the forecast methods used, forecast accuracy can be found by using forecast error methods are used which are mention in this synopsis.

KEYWORDS: Sales forecasting, Quantitative Method, Moving Average Method, Exponential Smoothing Method, Forecasting Error.

INDEX

CHAPTER NO .01 - INTRODUCTION

SALES FORECASTING

FIG 1.1 – SALES FORECASTING [9]

FIG 1.2 – SALES FORECASTING [8]

1.1 - PROBLEM DEFINITION

The problem recognize is **"to analyze the effectiveness of inventory control system"** of the company.

Below are the inventory problem faced by the company

1. IN 2016 , **NIKE** was struggling with excess inventory , leading to negative impact on its financial reports

FIG NO. : 1.1.1

2. **In 2015 , Target** suffer from loss of more than $ 2 billion due to mismatch inventory

FIG NO. : 1.1.2 **[12]**

3. In 2019 ,TATA MOTORS, M&M, production shut down due to unsold inventory

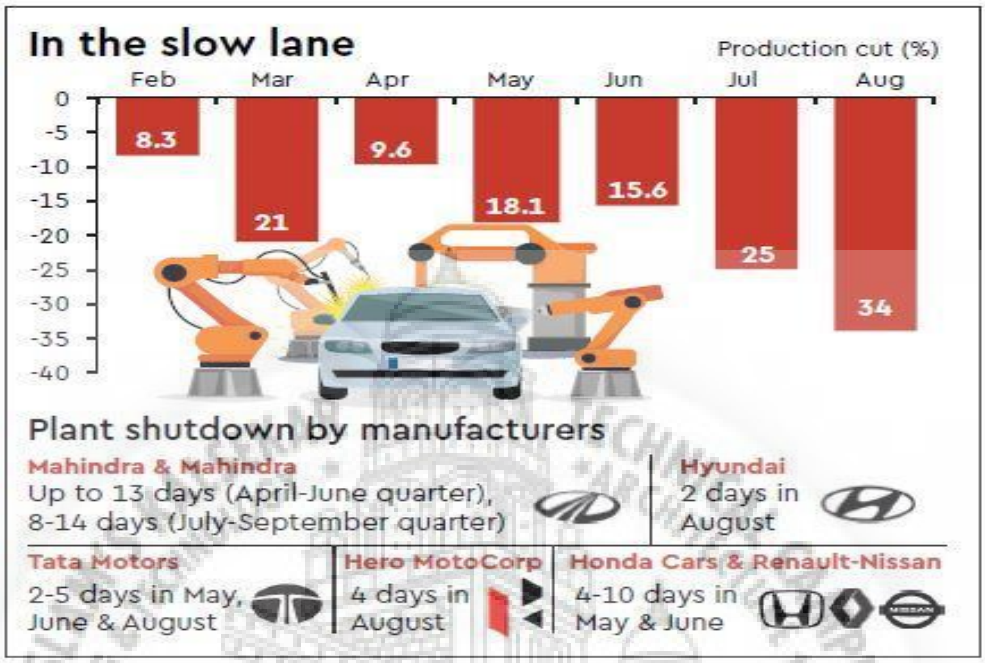


FIG NO. : 1.1.3 – [11]

4. IN 2019, SUBHAMS GEAR, not timely production of products in right number

FIG NO. 1.1.4

1.2 – AIM OF THE PROJECT

- Expand the business and make more profit by maintaining adequate inventory.

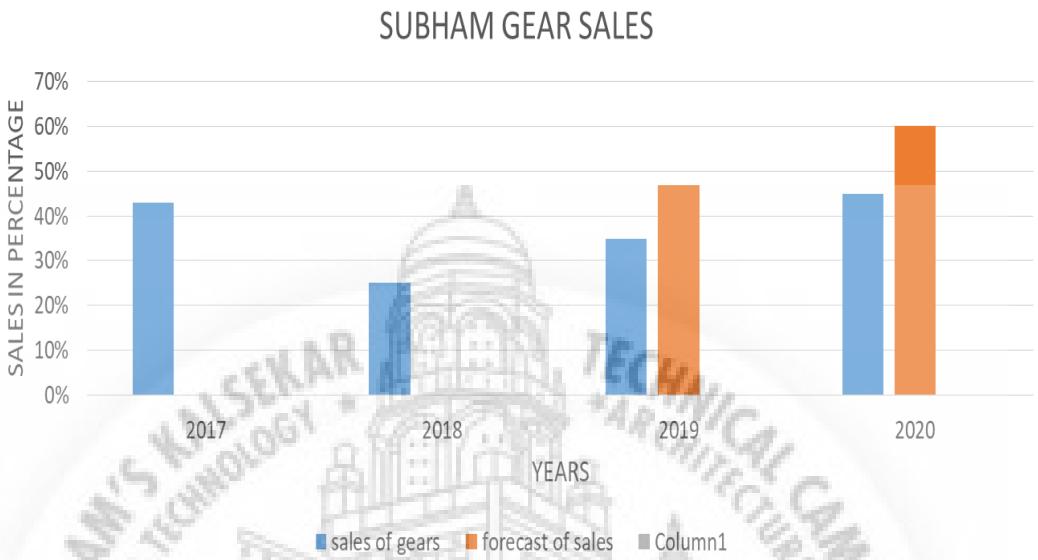


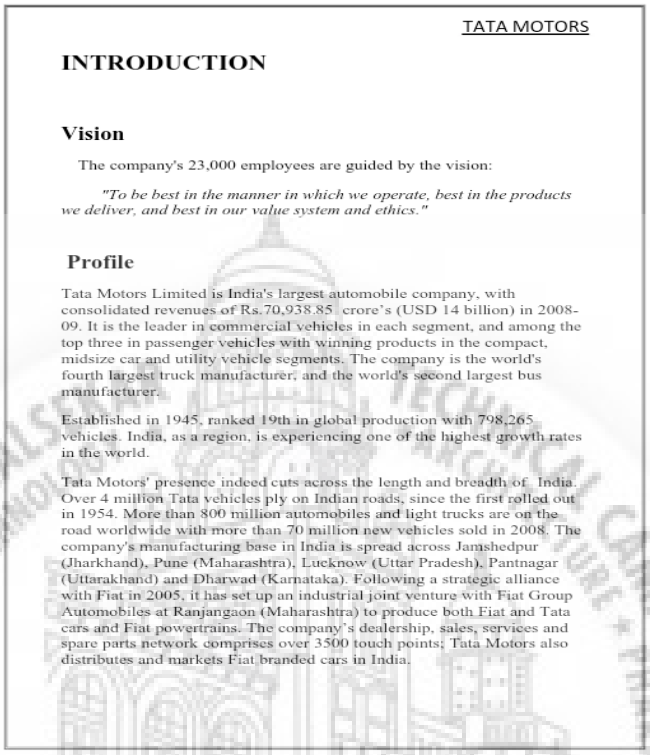
FIG NO. : 1.2.1

- To ensure the growth of the company from the small scale to become a big MNC.

FIG NO. : 1.2.2

CHAPTER NO.: 02 – LITERATURE SURVEY

➢ REVIEW THE PAPERS



TATA MOTORS

INTRODUCTION

Vision

The company's 23,000 employees are guided by the vision:

"To be best in the manner in which we operate, best in the products we deliver, and best in our value system and ethics."

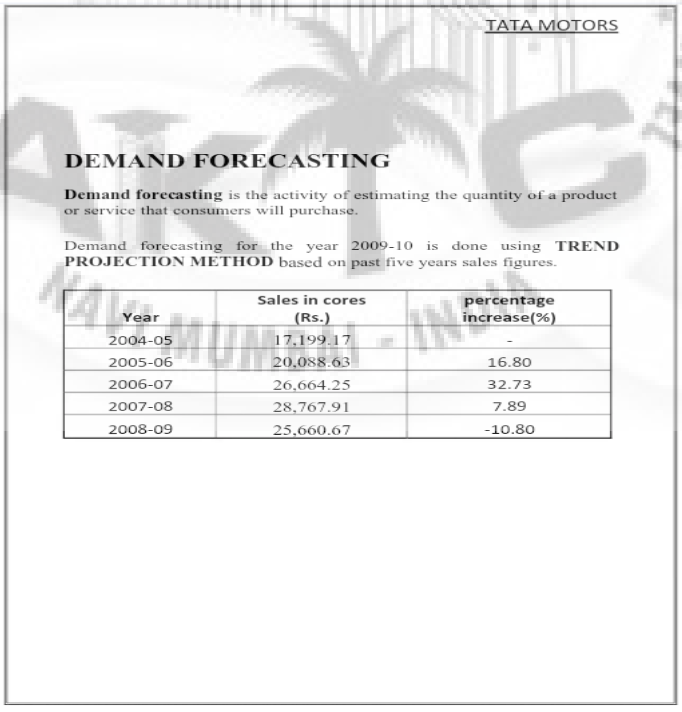
Profile

Tata Motors Limited is India's largest automobile company, with consolidated revenues of Rs.70,938.85 crore's (USD 14 billion) in 2008-09. It is the leader in commercial vehicles in each segment, and among the top three in passenger vehicles with winning products in the compact, midsize car and utility vehicle segments. The company is the world's fourth largest truck manufacturer, and the world's second largest bus manufacturer.

Established in 1945, ranked 19th in global production with 798,265 vehicles. India, as a region, is experiencing one of the highest growth rates in the world.

Tata Motors' presence indeed cuts across the length and breadth of India. Over 4 million Tata vehicles ply on Indian roads, since the first rolled out in 1954. More than 800 million automobiles and light trucks are on the road worldwide with more than 70 million new vehicles sold in 2008. The company's manufacturing base in India is spread across Jamshedpur (Jharkhand), Pune (Maharashtra), Lucknow (Uttar Pradesh), Pantnagar (Uttarakhand) and Dharwad (Karnataka). Following a strategic alliance with Fiat in 2005, it has set up an industrial joint venture with Fiat Group Automobiles at Ranjangaon (Maharashtra) to produce both Fiat and Tata cars and Fiat powertrains. The company's dealership, sales, services and spare parts network comprises over 3500 touch points; Tata Motors also distributes and markets Fiat branded cars in India.

FIG 2.1 – LITERATURE SURVEY [5]



TATA MOTORS

DEMAND FORECASTING

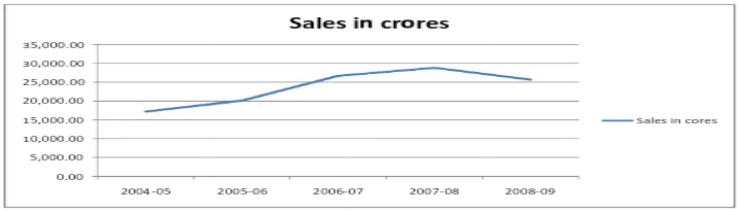
Demand forecasting is the activity of estimating the quantity of a product or service that consumers will purchase.

Demand forecasting for the year 2009-10 is done using **TREND PROJECTION METHOD** based on past five years sales figures.

Year	Sales in cores (Rs.)	percentage increase(%)
2004-05	17,199.17	-
2005-06	20,088.63	16.80
2006-07	26,664.25	32.73
2007-08	28,767.91	7.89
2008-09	25,660.67	-10.80

FIG 2.2 – LITERATURE SURVEY [5]

TATA MOTORS



Year	Sales in cores(Y)	X	X^2	XY
2004-05	17,199.17	1	1	17199.17
2005-06	20,088.63	2	4	40177.26
2006-07	26,664.25	3	9	79992.75
2007-08	28,767.91	4	16	115071.64
2008-09	25,660.67	5	25	128303.35
	∑Y=118380.63	∑X=15	∑X^2=55	∑XY=380744.17

Equation for the line:
y=a+bX

Y intercept and slope of the line using :
∑Y=Na+b∑X
∑XY=a∑X+b∑X^2

Substitute the values from the table in above equations:
1,18,380.63=5a+15b
380744.20=15a+55b

FIG 2.3 – LITERATURE SURVEY [5]

TATA MOTORS

by solving above, we get
a=15995.43
b=2560.23
therefore estimation for the year 2009-10 is as follows:

Y for	a+bX	sales forecasted
2005	15995.43+2560.23(1)	18555.66
2006	15995.43+2560.23(2)	21115.89
2007	15995.43+2560.23(3)	23676.12
2008	15995.43+2560.23(4)	26236.35
2009	15995.43+2560.23(5)	28796.58
2010	15995.43+2560.23(6)	**31356.81**

Therefore the demand forecasted for the year 2009-10 would be Rs.31, 356.81.

And the percentage change would be 22.20%

REASONS FOR FALL IN PROFIT IN 2008-09

- Tata Motors Net Revenue in 2008-09 lower at Rs.25660.79 crores, and Net Profit lower at Rs.1001.26 crores, was due to market upheaval.
- There was severe demand contraction in the automobile industry.
- Revenues for the year were Rs.25660.79 crores compared to Rs.28739.41 crores in 2007-08, a decline of 10.7%. The Profit before Tax was Rs.1013.76 crores compared to Rs.2576.47 crores in 2007-08, a decline of 60.7%. The Profit after Tax for the year was Rs.1001.26 crores compared to Rs.2028.92 crores, a decline of 50.7%.
- The demand contraction was triggered by high interest rates and unavailability of finance throughout the year, particularly in the October-December quarter post the global financial market upheavals.

FIG 2.4 – LITERATURE SURVEY [5]

In order to determine whether the project is in right path or not survey of the related information used for the benefits of the company is necessary .From the above review papers conclusion come out of it is that the methods of forecasting used in this project is the better options in order to apply the sales forecasting to subhams gear industry.

- **INDUSTRIAL SURVEY**

JOHNSON MATTHEY

Plot no. 6A, MIDC Industrial Estate

Taloja, District - Raigad

Maharashtra, India - 410208

FIG NO. : 2.5 – Johnson Matthey

From the survey we come to know that in order to do inventory management this company make use of 5s, kaizen, etc. They also have the separate department of forecasting in order to place the order and according to that manufacturing process is done. In this company there is also a separate department for supply chain management. The manufacturing process, ordering process, demand fulfilment is adequate, and there is no problem of overflow inventory and underflow inventory. Then we taken the decision to implement all the concepts of forecasting in order to manage the manufacturing process of the product from the raw material to the finished parts for the small scale industries in order to give growth path for the company.

CHAPTER NO. : 03 – TOTAL COST OF THE PROJECT

SR NO.	PARTICULARS	QUANTITY	COST (RS)
1	TRAVELLING	30*4*12	2400
2	BOOK	20*1	20
3	PROJECT DAIRY	45*1	45
4	MISCELLANEOUS	30	530
TOTAL COST (RS)			2995 RS

TABLE 1- COST OF PROJECT

CHAPTER NO. : 04 – METHODOLOGY

The method which is followed in order to complete the project in the proper and the systematic way is illustrated in the below figure. The very first step to initialize the project is to determine what is purpose of the project topic i.e. sales forecasting .why the sales forecasting is necessary for the sales of the company product? In the first step determination of purpose of project is determine that is in any manufacturing company the very important problem is the sales of the product. The production of the product is more than the sales of their product. Hence to avoid the warehousing of the product, quality deterioration, sales planning is very important. Sales are forecasted and the production schedule will be planned accordingly.

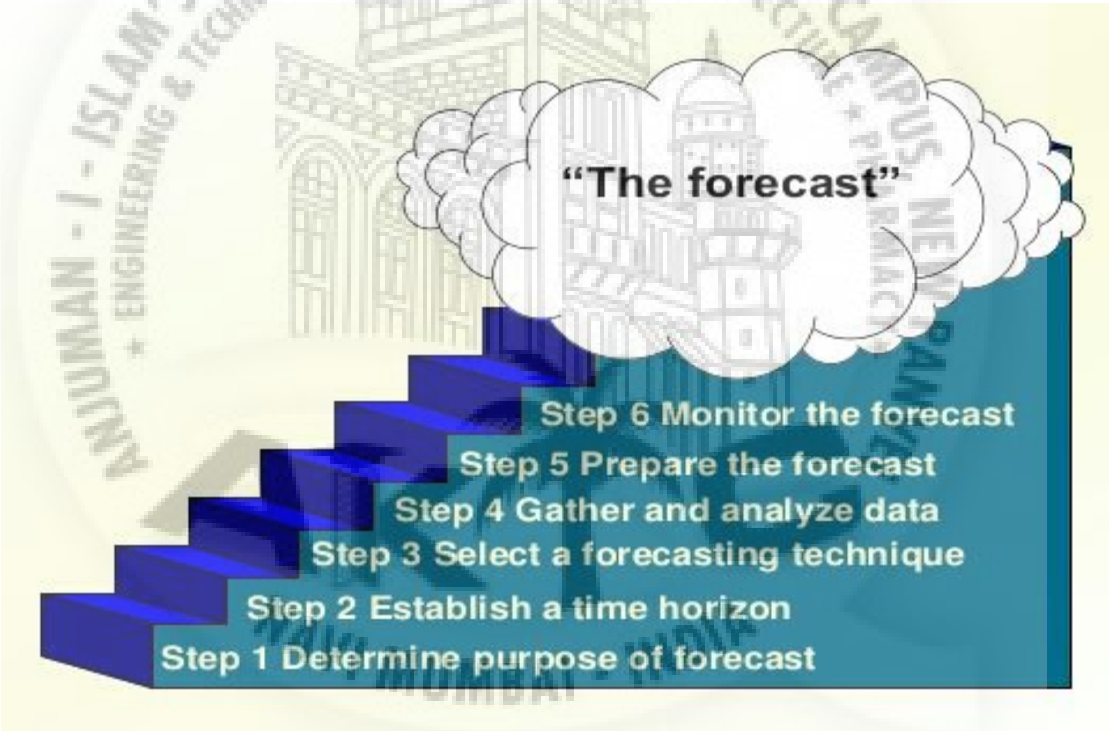


FIG 4.1 – METHODOLOGY USED FOR THE COMPLETION OF PROJECT [4]

The second step is establish a time horizon for the sales forecast of the company's product. In this step the time horizon for the forecasting is about 12 months that is decided. The time horizon should not be too lengthy i.e. 10 years. For example 5 months. The third step for the success towards the forecasting is to determine what would be forecasting techniques that can be implemented for sales forecasting of the

Product.Three the methods that can be used are Moving Average Method, Exponential Smoothing Method, Least Square Method. The forth step is to gather and analyze data. In this step gather the data required for forecasting of sales for the product for example, demand for the particular product for the 12 months. As the time horizon is decided 12 months in the step two. As soon as the data is collected from the company about the product which is required for the further process apply the techniques which is decided in the step three i.e. three method Moving Average Method, Exponential Smoothing Method, Least Square Method. As the methods of forecasting is applied than forecast for the next month can be obtain. This is the step in which whatever results get through forecasting method is to be analyze by using forecasting error method. The forecasting error is the difference between the actual sales and the predicted sales i.e. forecasted sales. By using this method analyzation of the method is done in this step. The fifth step is to prepare the forecast i.e. whatever the error get by comparing the error of all the methods which method is having minimum error that method of forecasting will be used for the forecasting of the sales of the product for the company. So we can prepare the forecast by coming with the conclusion that which method is to apply for the sales forecasting. The last step is to monitor the forecast which is determine by applying the method of forecasting. By following the above steps forecasting for sales of the product for the company can be done more properly, easily, accurately.

CHAPTER NO. : 05 – ANALYZING METHODS FOR SALES FORECASTING

- APPROACH IN FORECASTING

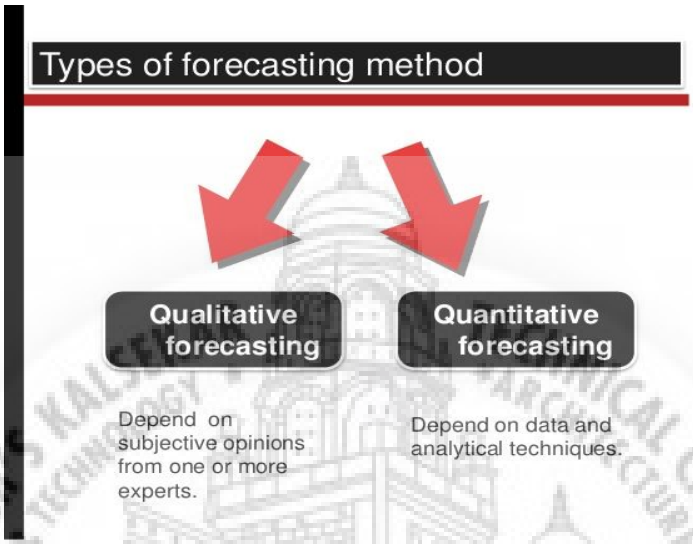


FIG N0. : 5.1 – Types of forecasting methods **[10]**

1. QUALITATIVE FORECASTING

[2] This method mainly consist of subjective inputs, which often defy precise numerical description. It involve either the projection of historical data or the development of associates models that attempt to utilize casual variables to make a forecast. This method of forecasting is depending on the experience, knowledge and sixth sense of their own people.

The types of qualitative forecasting methods are listed below:

1. **Executive opinions**: The opinions of experts from different departments are considered and averaged to forecast the future sales. This method of forecasting can be done easily and quickly without the necessity of elaborate statistics. But the main disadvantage is that it depends on individual opinions that may not be unanimous and can vary from individual to individual which could lead to wrong forecasting.

2. **Delphi technique**: In this method, panels of experts are selected and are individually questioned about the upcoming events. They do not form a group. For long-range forecasting, this method is beneficial and very effective. The main disadvantage of this method is that from the returns there is lack of and low reliability.

3. **Consumer surveys**: In this method, the survey is conducted directly on the customers on their purchases. The surveys can be done through telephone contacts, personal interviews or questionnaires to obtain data from the customers. This method requires extensive statistical analysis to test regarding the consumer behavior.

4. **Salesforce polling**: In this method, the forecast is done based on the opinions of salespeople who have steady interactions with the clients. As they are closest to the customers, they can better predict the requirements of the customers for the future market. The main advantage of this forecasting method is that it is very simple to use and understand. The information can be segregated easily into different categories. But the drawback is that the salespeople can be either optimistic or pessimistic about their predictions and this could lead to inaccurate forecasting.

In general, all the forecasting techniques assume the underlying relationship in the past and predict the relationship for the future. Most of the techniques are based on some previous data, opinions, surveys, etc.

2. **QUANTITATIVE FORECASTING**

[2] It is a statistical technique to make predictions about the future which uses numerical measures and prior effects to predict future events. These techniques are based on models of mathematics and in nature are mostly objective. They are highly dependent on mathematical calculations.

There are two types of quantitative forecasting methods which are listed below:

1. **Time-series models** – These models examine the past data patterns and forecast the future on the basis of underlying patterns that are obtained from those data. There are many types of time series models like Simple and weighted moving average, seasonal indexes, trend projections, simple mean and exponential smoothing.

2. **Associative models** – are also known as casual models. The model assumes that the variable that is being forecasted is associated with other variables. The predictions are made based on these associations. The linear regression is one of the simplest forms of an associative model of forecasting. This regression line forecasts the dependent variable based on the selected value of the independent variable.

Quantitative forecasting methods are very easy to predict based on the underlying information. The data can be used to forecast automatically without many complications. Any person can easily forecast on the basis of available data.

One of the main disadvantages of this method is its dependence on the data. The entire forecasting depends on the data of the underlying model. An error in the available data can lead to wrong forecasting. These methods can also be used only if the proper data is available. This method cannot also evaluate the effect of changes in the other variables involved.

NOTE: In this project we are using **QUANTITATIVE METHOD** for forecasting of sales in Subham gear

FORECASTING TECHNIQUES USED ARE AS FOLLOWS:[1]

1. MOVING AVERAGE METHOD
2. EXPONENTIAL SMOOTHING METHOD
3. LEAST SQUARE METHOD

- **MOVING AVERAGE METHOD**

A moving average is a technique to get an overall idea of the trends in a data set; it is an average of any subset of numbers. The moving average is extremely useful for forecasting long-term trends. You can calculate it for any period of time. For example, if you have sales data for a twenty-year period, you can calculate a five-year moving average, a four-year moving average, a three-year moving average and so on. Stock market analysts will often use a 50 or 200 day moving average to help them see trends in the stock market and (hopefully) forecast where the stocks are headed. An average represents the "middling" value of a set of numbers. The moving average is exactly the same, but the average is calculated several times for several subsets of data. For example, if you want a two-year moving average for a data set from 2000, 2001, 2002 and 2003 you would find averages for the subsets 2000/2001, 2001/2002 and 2002/2003. Moving averages are usually plotted and are best visualized.

Example:

[3] Calculating a 3-Year Moving Average for the following

YEAR	VALUES
1921	6
1922	8
1923	4
1924	5
1925	3
1926	7

TABLE 2- DATA EXAMPLE (1)

SOLUTION:

In this method, similar to the numerical solved earlier take the three year values successively, add the values, find the average and write its values in between the first and third set of values chosen. As shown in the above table take first three set of year values 1921, 1922, 1923 --- $\frac{6+8+4}{3} = \frac{18}{3} = 6$

YEAR	VALUES	3-YEARS TOTAL	3-YEARS MOVING AVERAGE
1921	6	-	-
1922	8	18	6
1923	4	17	5.66
1924	5	12	4
1925	3	15	5
1926	7	-	-

TABLE 3 – SOLUTION OF EXAMPLE DATA BY MOVING AVERAGE METHOD

Forecasting for the year 1927 is therefore 5 values.

➢ EXPONENTIAL SMOOTHING METHOD

Exponential smoothing is a time series forecasting method for invariant data. Exponential smoothing forecasting methods are similar in that a prediction is a weighted sum of past observations, but the model explicitly uses an exponentially decreasing weight for past observations. Specifically, past observations are weighted with a geometrically decreasing ratio. Forecasts produced using exponential smoothing methods are weighted averages of past observations, with the weights decaying exponentially as the observations get older. In other words, the more recent the observation the higher the associated weight.

EXAMPLE:

For a particular product demand is shown below. Forecast for the month was 150 units. With a smoothing constant of 0.2 and using first order exponential smoothing. What is the forecasting for the month of September?

SOLUTION:

[3] Forecasting for the period, $F_{T+1} = F_{T-1} + \alpha (D_{T-1} - F_{T-1})$

Forecasting for May,

$F_T = 150 + 0.2(200-150) = 160$ UNITS

Forecasting for June,

$F_T = 160 + 0.2 (150-160) = 158$ UNITS

Forecasting for July,

F_T = 158 + 0.2 (180-158) = 162 UNITS

Forecasting for August,

F_T = 162 + 0.2 (220-162) = 174 UNITS

Forecasting for September,

F_T = 174 + 0.2 (200-174) = 179 UNITS

MONTHS	ACTUAL DEMAND	FORECASTING DEMAND
APRIL	200	150
MAY	150	160
JUNE	180	158
JULY	220	162
AUGUST	200	174
SEPTEMBER		179

TABLE 4 – SOLUTION OF EXAMPLE DATA BY EXPONENTIAL METHOD

- **LEAST SQUARE METHOD:**

This is a best method of obtaining forecasting values. It provides a convenient basis for obtaining the line of best fit in a series. The sum of the square of the deviation of various points from the line of best fit is the least. That is why this method is known as method of least squares. The straight line equation becomes, **Y=a + bx**

Where, Y = Estimated value of the equation

X = Represent the deviations in time period

a = b = constants

Where, $a = \frac{\sum Y}{N}$, $b = \frac{\sum XY}{\sum X^2}$

Where, N = Number of years for which the data is given.

EXAMPLE:

Find the sales for 2005 by least square method for data as follows

YEAR	2000	2001	2002	2003	2004
SALES	35	56	79	80	40

TABLE 5 – DATA EXAMPLE (2)

SOLUTION:

Substituting below values in the equation, Y = a + bX

Where, $a = \frac{\sum y}{N} = \frac{290}{5}$ = 58 UNITS

$$b = \frac{\sum XY}{\sum X^2} = \frac{34}{10} = 3.4$$

The equation of straight line is Y = 58 + 3.4 * X

For year 2005, x = 3 [3]

Therefore, Y = 58 + 3.4 * 3 = 70 UNITS

The forecast of year 2005 is 70 units.

YEAR	SALES	X	X^2	XY
2000	35	-2	4	-70
2001	56	-1	1	-56
2002	79	0	0	0
2003	80	1	1	80
2004	40	2	4	80
TOTAL	$\sum Y = 290$	$\sum X = 0$	$\sum X^2 = 10$	$\sum XY = 34$

TABLE 6 – SOLUTION OF EXAMPLE DATA BY LEAST SQUARE METHOD

METHODS	ADVANTAGES	DISADVANTAGES
Moving Average Method	1. Simple method 2. Flexible method	1. No trend values for some year. 2. In case of nonlinear trend the values obtained by this method are biased in one or the other direction.
Exponential Smoothing Method	1. It is easy to learn and apply. 2. It produces accurate forecast	1. It cannot handle trend well. 2. It produces forecasting that lag behind the actual trend.
Least Square Method	1. This method gives the trend values for the entire time period. 2. This is a completely objective methods.	1. If even a single item is added to the series a new equation has to be formed. 2. It requires some amount of calculation and may appear tedious and complicated.

TABLE 7 – ADVANTAGES AND DISADVANTAGES OF METHODS

CHAPTER NO. 6 – IMPLEMENTATION OF FORECASTING METHODS

1. COLLECTION OF DATA FROM COMPANY SUBHAMS GEAR

PRODUCT 1- ARMATURE SHAFT WITH BALL ASSEMBLY

PRODUCT	MONTHS (18-19)	SALES
ARMATURE SHAF WITH BALL ASSEMBLY	APRIL	31500
	MAY	22000
	JUNE	30500
	JULY	30000
	AUGUST	36200
	SEPTEMBER	31200
	OCTOBER	31100
	NOVEMBER	28000
	DECEMBER	36000
	JANUARY	28800
	FEBRUARY	45000
	MARCH	46000

TABLE 8 – DATA OF PRODUCT 1 – ARMATURE SHAT WITH BALL ASSEMBLY

PRODUCT 2 – ARMATURE SHAFT 266 MM

PRODUCT	MONTHS (18-19)	SALES
ARMATURE SHAFT WITH 266 MM	APRIL	143
	MAY	130
	JUNE	406
	JULY	51
	AUGUST	219
	SEPTEMBER	1343
	OCTOBER	541
	NOVEMBER	1275
	DECEMBER	581
	JANUARY	732
	FEBRUARY	549
	MARCH	17

TABLE 9 –DATA OF PRODUCT 2 – ARMATURE SHAFT 266 MM

PRODUCT 3 – REDUCTION GEAR

PRODUCT	MONTHS (18-19)	SALES
REDUCTION GEAR	APRIL	8000
	MAY	5000
	JUNE	9100
	JULY	10900
	AUGUST	18900
	SEPTEMBER	15100
	OCTOBER	11600
	NOVEMBER	13000
	DECEMBER	7400
	JANUARY	11700
	FEBRUARY	13100
	MARCH	10100

TABLE 10 – DATA OF PRODUCT 3 – REDUCTION GEAR

PRODUCT 4 – HELICAL GEAR

PRODUCT	MONTHS (18-19)	SALES
HELICAL GEAR	APRIL	15000
	MAY	5000
	JUNE	5500
	JULY	6500
	AUGUST	6700
	SEPTEMBER	13200
	OCTOBER	12500
	NOVEMBER	8800
	DECEMBER	14400
	JANUARY	17300
	FEBRUARY	12700
	MARCH	14500

TABLE 11 – DATA OF PRODUCT 4 – HELICAL GEAR

PRODUCT 5- ARMATURE SHAFT

PRODUCT	MONTHS (18-19)	SALES
ARMATURE SHAFT	APRIL	15000
	MAY	0
	JUNE	7000
	JULY	10100
	AUGUST	11300
	SEPTEMBER	10600
	OCTOBER	9500
	NOVEMBER	9100
	DECEMBER	7200
	JANUARY	4000
	FEBRUARY	3500
	MARCH	12000

TABLE 12 – DATA OF THE PRODUCT 5 – ARMATURE SHAFT

For the implementation of the method, the first step is to collect the data which the above mentions data.

2. Application of **MOVING AVERAGE METHOD, EXPONENTIAL SMOOTHING METHOD, LEAST SQUARE METHOD** to all the products of the company as mention above data.

PRODUCT 1- ARMATURE SHAFT WITH BALL ASSEMBLY

(A) Apply **Moving Average Method** using **three months moving average**

MONTHS (18-19)	SALES	3 MONTHS MOVING	3 MONTHS MOVING AVERAGE
APRIL	31500		
MAY	22000	84000	28000
JUNE	30500	82500	27500
JULY	30000	96700	32234
AUGUST	36200	97400	32467
SEPTEMBER	31200	98500	32834
OCTOBER	31100	90300	30100
NOVEMBER	28000	95100	31700
DECEMBER	36000	92800	30934
JANUARY	28800	109800	36600
FEBRUARY	45000	119800	39933
MARCH	46000		

TABLE 13 – SOLUTION OF PRODUCT 1 BY MOVING AVERAGE

Using Three years Moving Average Method the forecast for the month April is **39933** units.

(B) Apply **Exponential smoothing** method for $\alpha = 0.15$

MONTHS (18-19)	SALES	FORECAST SALES
APRIL	31500	33025
MAY	22000	32797
JUNE	30500	31178
JULY	30000	31077
AUGUST	36200	30916
SEPTEMBER	31200	31709
OCTOBER	31100	31633
NOVEMBER	28000	31553
DECEMBER	36000	31020
JANUARY	28800	31767
FEBRUARY	45000	31322
MARCH	46000	33374

TABLE 14 – SOLUTION OF PRODUCT 1 BY EXPONENTIAL SMOOTHING METHOD

Forecast for April 18 is given by, sum of all the sales / no. of months.

Forecast for the month is given by,

$F_T = F_{(T-1)} + \alpha (S_{(T-1)} - F_{(T-1)})$

COEFFCIENT OF SMOOTHING = $\alpha = \frac{2}{N+1} = 0.15$

FORECASTING FOR APRIL IS,

$F_{(MARCH)} + \alpha (S_{(MARCH)} - F_{(MARCH)}) = F_{(APRIL)}$ = 33374+0.15 (46000-33374)

= 35268 UNITS

(C) Apply **least square method**

MONTHS (18-19)	SALES	X	X^2	XY
APRIL	31500	-11	121	-346500
MAY	22000	-9	81	-198000
JUNE	30500	-7	49	-213500
JULY	30000	-5	25	-150000
AUGUST	36200	-3	9	-108600
SEPTEMBER	31200	-1	1	-31200
OCTOBER	31100	1	1	31100
NOVEMBER	28000	3	9	84000
DECEMBER	36000	5	25	180000
JANUARY	28800	7	49	201600
FEBRUARY	45000	9	81	405000
MARCH	46000	11	121	506000
N = 12	396300	0	572	359900
	SUM (Y)	SUM (X)	SUM(X^2)	SUM(XY)

TABLE 15 – SOLUTION OF THE PRODUCT 1 BY LEAST SQUARE METHOD

$a = \sum Y / N = 396300 / 12 = 33025$

$b = \sum XY / \sum X^2 = 359900 / 572 = 630$

The equation of straight line is Y = a + bx,

= 33025 + 630 x x

For the value of x for the month of April the midpoint value become 12

Therefore, Y (APRIL 19) = 40585 UNITS

PRODUCT 2 – ARMATURE SHAFT 266 MM

(a) Apply **Moving Average Method** by using Three months moving

MONTHS (18-19)	SALES	3 MONTHS MOVING	3 MONTHS MOVING AVERAGE
APRIL	143		
MAY	130	679	227
JUNE	406	587	196
JULY	51	676	226
AUGUST	219	1613	538
SEPTEMBER	1343	2103	701
OCTOBER	541	3159	1053
NOVEMBER	1275	2397	799
DECEMBER	581	2588	863
JANUARY	732	1862	621
FEBRUARY	549	1298	433
MARCH	17		

TABLE 16 – SOLUTION OF PRODUCT 2 BY MOVING AVERAGE METHOD

Using three months moving average the forecasting for the month April is **433** units.

(B)Apply **Exponential Smoothing Method** By using $\alpha = 0.15$

MONTHS (18-19)	SALES	FORECAST SALES
APRIL	143	499
MAY	130	553
JUNE	406	490
JULY	51	478
AUGUST	219	414
SEPTEMBER	1343	385
OCTOBER	541	529
NOVEMBER	1275	531
DECEMBER	581	643
JANUARY	732	634
FEBRUARY	549	649
MARCH	17	634

TABLE 17 – SOLUTION OF PRODUCT 2 BY EXPONENTIAL SMOOTHING METHOD

Forecast for April 18 is given by, sum of all the sales / no. of months.

Forecast for the month is given by, $F_T = F_{(T-1)} + \alpha (S_{(T-1)} - F_{(T-1)})$

Coefficient of smoothing = $\alpha = \frac{2}{N+1} = 0.15$

Forecasting for the month April 19 is, $F_{(T)} = F_{(T-1)} + \alpha (S_{(T-1)} - F_{(T-1)})$

$= 634 + 0.15(17 - 634)$

$= 542$ UNITS.

(C) Apply **LEAST SQUARE METHOD**

MONTHS (18-19)	SALES (Y)	X	X^2	XY
APRIL	143	-11	121	-1573
MAY	130	-9	81	-1170
JUNE	406	-7	49	-2842
JULY	51	-5	25	-255
AUGUST	219	-3	9	-657
SEPTEMBER	1343	-1	1	-1343
OCTOBER	541	1	1	541
NOVEMBER	1275	3	9	3825
DECEMBER	581	5	25	2905
JANUARY	732	7	49	5124
FEBRUARY	549	9	81	4941
MARCH	17	11	121	187
N = 12	5987	0	572	9683
	SUM (Y)	SUM(X)	SUM (X^2)	SUM (XY)

TABLE 18 – SOLUTION OF PRODUCT 2 LEAST SQUARE METHOD

$a = \sum Y / N = 5987 / 12 = 499$

$b = \sum XY / \sum X^2 = 9683 / 572 = 17$

The equation of straight line is $Y = a + bx$,

$= 499 + 17 \times x$

For the value of x for the month of April the midpoint value become 12

Therefore, Y (APRIL 19) = 703 UNITS

PRODUCT 3 - REDUCTION GEAR

(A)Apply **Moving Average Method** for Three months moving average

MONTHS (18-19)	SALES	3 MONTHS MOVING	3 MONTHS MOVING AVERAGE
APRIL	8000		
MAY	5000	22100	7367
JUNE	9100	25000	8334
JULY	10900	38900	12967
AUGUST	18900	44900	14967
SEPTEMBER	15100	45600	15200
OCTOBER	11600	39700	13234
NOVEMBER	13000	32000	10667
DECEMBER	7400	32100	10700
JANUARY	11700	32200	10734
FEBRUARY	13100	34900	11633
MARCH	10100		

TABLE 19 SOLUTION OF PRODUCT 3 REDUCTION GEAR BY MOVING AVERAGE METHOD

Using Three Months Moving Average Method the forecast for the month April is **11633 units.**

(B) Apply **Exponential smoothing** method for $\alpha = 0.15$

MONTHS (18-19)	SALES	FORECASTED SALES
APRIL	8000	11158
MAY	5000	10684
JUNE	9100	9831
JULY	10900	9721
AUGUST	18900	9898
SEPTEMBER	15100	11248
OCTOBER	11600	11826
NOVEMBER	13000	11792
DECEMBER	7400	11973
JANUARY	11700	11287
FEBRUARY	13100	11349
MARCH	10100	11612

TABLE 20 – SOLUTION OF PRODUCT 3 BY EXPONENTIAL SMOOTHING METHOD

Forecast for April 18 is given by, sum of all the sales / no. of months.

Forecast for the month is given by,

$F_T = F_{(T-1)} + \alpha (S_{(T-1)} - F_{(T-1)})$

COEFFCIENT OF SMOOTHING = $\alpha = \frac{2}{N+1}$

FORECASTING FOR APRIL IS,

$F_{(MARCH)} + \alpha (S_{(MARCH)} - F_{(MARCH)}) = F_{(APRIL)}$ = 11612+0.15 (10100-11612)

= 11385 UNITS

(C) Apply **least square method**

MONTHS (18-19)	SALES (Y)	X	X^2	XY
APRIL	8000	-11	121	-88000
MAY	5000	-9	81	-45000
JUNE	9100	-7	49	-63700
JULY	10900	-5	25	-54500
AUGUST	18900	-3	9	-56700
SEPTEMBER	15100	-1	1	-15100
OCTOBER	11600	1	1	11600
NOVEMBER	13000	3	9	39000
DECEMBER	7400	5	25	37000
JANUARY	11700	7	49	81900
FEBRUARY	13100	9	81	117900
MARCH	10100	11	121	111100
N = 12	8000	0	572	75500
	SUM (Y)	SUM (X)	SUM(X^2)	SUM (XY)

TABLE 21 – SOLUTION OF PRODUCT 3 BY LEAST SQUARE METHOD

$a = \sum Y / N$ = 133900 / 12 = 11158

$b = \sum XY / \sum X^2$ = 75500 / 572 = 132

The equation of straight line is Y = a + bx,

= 11158 + 132 x x

For the value of x for the month of April the midpoint value become 12

Therefore, Y (APRIL 19) = 12742 UNITS

PRODUCT 4 - HELICAL GEAR

(A)Apply **Moving Average Method** using three months moving average

MONTHS (18-19)	SALES	3 MONTHS MOVING	3 MONTHS MOVING AVERAGE
APRIL	15000		
MAY	5000	25500	8500
JUNE	5500	17000	5667
JULY	6500	18700	6234
AUGUST	6700	26400	8800
SEPTEMBER	13200	32400	10800
OCTOBER	12500	34500	11500
NOVEMBER	8800	35700	11900
DECEMBER	14400	40500	13500
JANUARY	17300	44400	14800
FEBRUARY	12700	44500	14833
MARCH	14500		

TABLE 22 – SOLUTION OF PRODUCT 4 BY MOVING AVERAGE METHOD

Using Three years Moving Average Method the forecast for the month April is **14833** UNITS.

(B) Apply **Exponential smoothing** method for $\alpha = 0.15$

MONTHS (18-19)	SALES	FORECASTED SALES
APRIL	15000	11008
MAY	5000	11607
JUNE	5500	10616
JULY	6500	9849
AUGUST	6700	9347
SEPTEMBER	13200	8950
OCTOBER	12500	9588
NOVEMBER	8800	10025
DECEMBER	14400	9842
JANUARY	17300	10526
FEBRUARY	12700	11542
MARCH	14500	11716

TABLE 23 – SOLUTION OF PRODUCT 4 BY EXPONENTIAL SMOOTHING METHOD

Forecast for April 18 is given by, sum of all the sales / no. of months.

Forecast for the month is given by, $F_T = F_{(T-1)} + \alpha (S_{(T-1)} - F_{(T-1)})$

COEFFCIENT OF SMOOTHING = $\alpha = \frac{2}{N+1}$

FORECASTING FOR APRIL IS,

$F_{(MARCH)} + \alpha (S_{(MARCH)} - F_{(MARCH)}) = F_{(APRIL)}$ = 11716+0.15 (14500-11716)

= 12134 UNITS

(C) Apply **least square method**

MONTHS (18-19)	SALES (Y)	X	X^2	XY
APRIL	15000	-11	121	-165000
MAY	5000	-9	81	-45000
JUNE	5500	-7	49	-38500
JULY	6500	-5	25	-32500
AUGUST	6700	-3	9	-20100
SEPTEMBER	13200	-1	1	-13200
OCTOBER	12500	1	1	12500
NOVEMBER	8800	3	9	26400
DECEMBER	14400	5	25	72000
JANUARY	17300	7	49	121100
FEBRUARY	12700	9	81	114300
MARCH	14500	11	121	159500
N = 12	132100	0	572	191500
	SUM (Y)	SUM(X)	SUM (X^2)	SUM (XY)

TABLE 24 – SOLUTION OF PRODUCT 4 BY LEAST SQUARE METHOD

$a = \sum Y / N$ = 132100 / 12 = 11008

$b = \sum XY / \sum X^2$ = 75500 / 572 = 335

The equation of straight line is Y = a + bx,

= 11008 + 335 x x

For the value of x for the month of April the midpoint value become 12

Therefore, Y (APRIL 19) = 15028 UNITS

PRODUCT 5 - ARMATURE SHAFT

(A)Apply **Moving Average Method** using **three months moving average**

MONTHS (18-19)	SALES	3 MONTHS MOVING	3 MONTHS MOVING AVERAGE
APRIL	15000		
MAY	0	22000	7334
JUNE	7000	17100	5700
JULY	10100	28400	9467
AUGUST	11300	32000	10667
SEPTEMBER	10600	31400	10467
OCTOBER	9500	29200	9734
NOVEMBER	9100	25800	8600
DECEMBER	7200	20300	6767
JANUARY	4000	14700	4900
FEBRUARY	3500	19500	6500
MARCH	12000		

TABLE 25 – SOLUTION OF PRODUCT 5 BY MOVING AVERAGE METHOD

Using Three years Moving Average Method the forecast for the month April is **6500** UNITS.

(B) Apply **Exponential smoothing** method for $\alpha = 0.15$

MONTHS (18-19)	SALES	FORECASTED SALES
APRIL	15000	8275
MAY	0	9284
JUNE	7000	7892
JULY	10100	7758
AUGUST	11300	8109
SEPTEMBER	10600	8588
OCTOBER	9500	8890
NOVEMBER	9100	8982
DECEMBER	7200	9000
JANUARY	4000	8730
FEBRUARY	3500	8021
MARCH	12000	7343

TABLE 26 – SOLUTION OF PRODUCT 5 BY EXPONENTIAL SMOOTHING METHOD

Forecast for April 18 is given by, sum of all the sales / no. of months.

Forecast for the month is given by, $F_T = F_{(T-1)} + \alpha (S_{(T-1)} - F_{(T-1)})$

COEFFCIENT OF SMOOTHING = $\alpha = \frac{2}{N+1}$

FORECASTING FOR APRIL IS,

$F_{(MARCH)} + \alpha (S_{(MARCH)} - F_{(MARCH)}) = F_{(APRIL)}$ = 7343+0.15 (12000-7343)

= 8042 UNITS

(C) Apply **least square method**

MONTHS (18-19)	SALES (Y)	X	X^2	XY
APRIL	15000	-11	121	-165000
MAY	0	-9	81	0
JUNE	7000	-7	49	-49000
JULY	10100	-5	25	-50500
AUGUST	11300	-3	9	-33900
SEPTEMBER	10600	-1	1	-10600
OCTOBER	9500	1	1	9500
NOVEMBER	9100	3	9	27300
DECEMBER	7200	5	25	36000
JANUARY	4000	7	49	28000
FEBRUARY	3500	9	81	31500
MARCH	12000	11	121	132000
N = 12	99300	0	572	-44700
	SUM (Y)	SUM(X)	SUM (X^2)	SUM (XY)

TABLE 27 – SOLUTION OF PRODUCT 5 BY LEAST SQUARE METHOD

$a = \sum Y / N$ = 99300 / 12 = 8275

$b = \sum XY / \sum X^2$ = -44700 / 572 = -78

The equation of straight line is Y = a + bx,

= 8275 + (-78) x x

For the value of x for the month of April the midpoint value become 12

Therefore, Y (APRIL 19) = 7339 UNITS

3. Determine the method which is best suited for forecasting the sales of the product by using forecasting error method [1]

FORECASTING ERROR = ACTUAL SALES OF THE PRODUCT – FORECASTED SALES OF THE PRODUCT

➢ PRODUCT 1 – ARMATURE SHAFT WITH BALL ASSEMBLY

1. MOVING AVERAGE METHOD :

Actual sales of the product is 33557 units.

Forecasted sales of the product is 39933 units.

FORECASTING ERROR = |33557 – 39933| = **6376 UNITS**

2. EXPONENTIAL SMOOTHING METHOD :

Actual sales of the product is 33198 units.

Forecasted sales of the product is 35268 units.

FORECASTING ERROR = |33198 – 35268| = **2070 UNITS**

3. LEAST SQUARE METHOD :

Actual sales of the product is 28684 units

Forecasted sales of the product is 40585 units.

FORECASTING ERROR = |28684 – 40585| = **11901 UNITS**

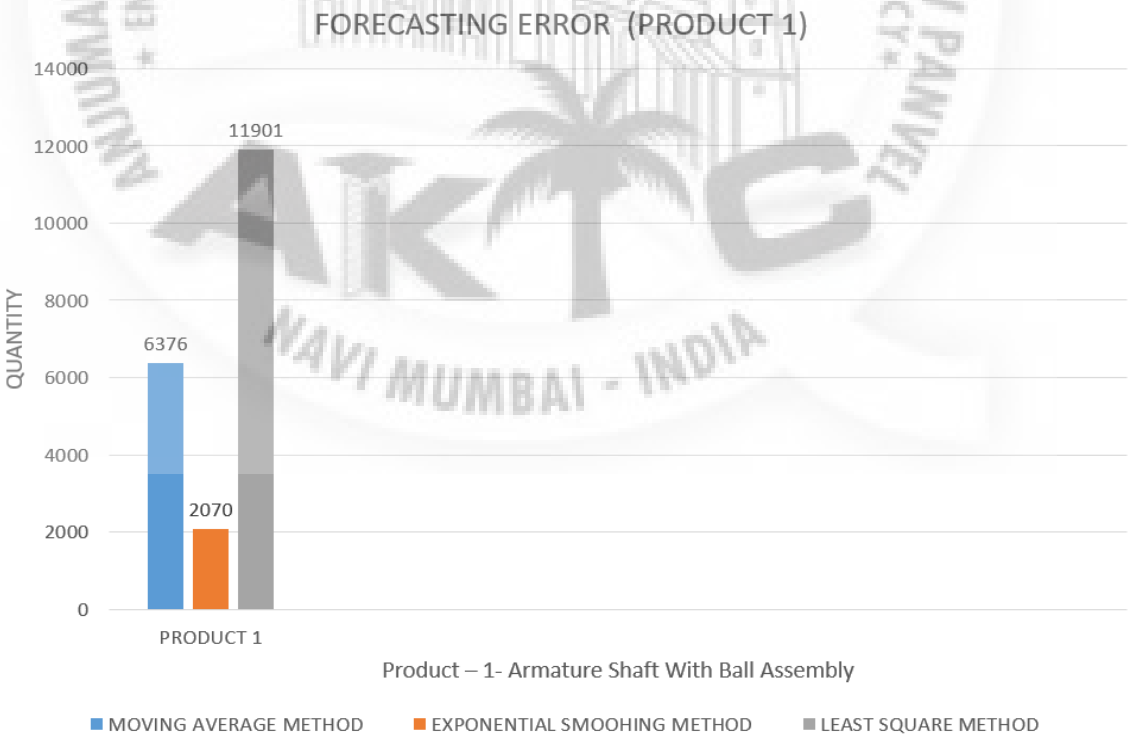


FIG: 6.3.1 – Forecasting Error of Product-1 of all the three methods

➢ PRODUCT 2 – ARMATURE SHAFT 266 MM

1. MOVING AVERAGE METHOD :

Actual sales of the product is 493 units.

Forecasted sales of the product is 433 units.

FORECASTING ERROR = |493 – 433| = **60 UNITS**

2. EXPONENTIAL SMOOTHING METHOD :

Actual sales of the product is 503 units.

Forecasted sales of the product is 542 units.

FORECASTING ERROR = |503 – 542| = **39 UNITS**

3. LEAST SQUARE METHOD :

Actual sales of the product is 515 units

Forecasted sales of the product is 618 units.

FORECASTING ERROR = |515 – 618| = **103 UNITS**

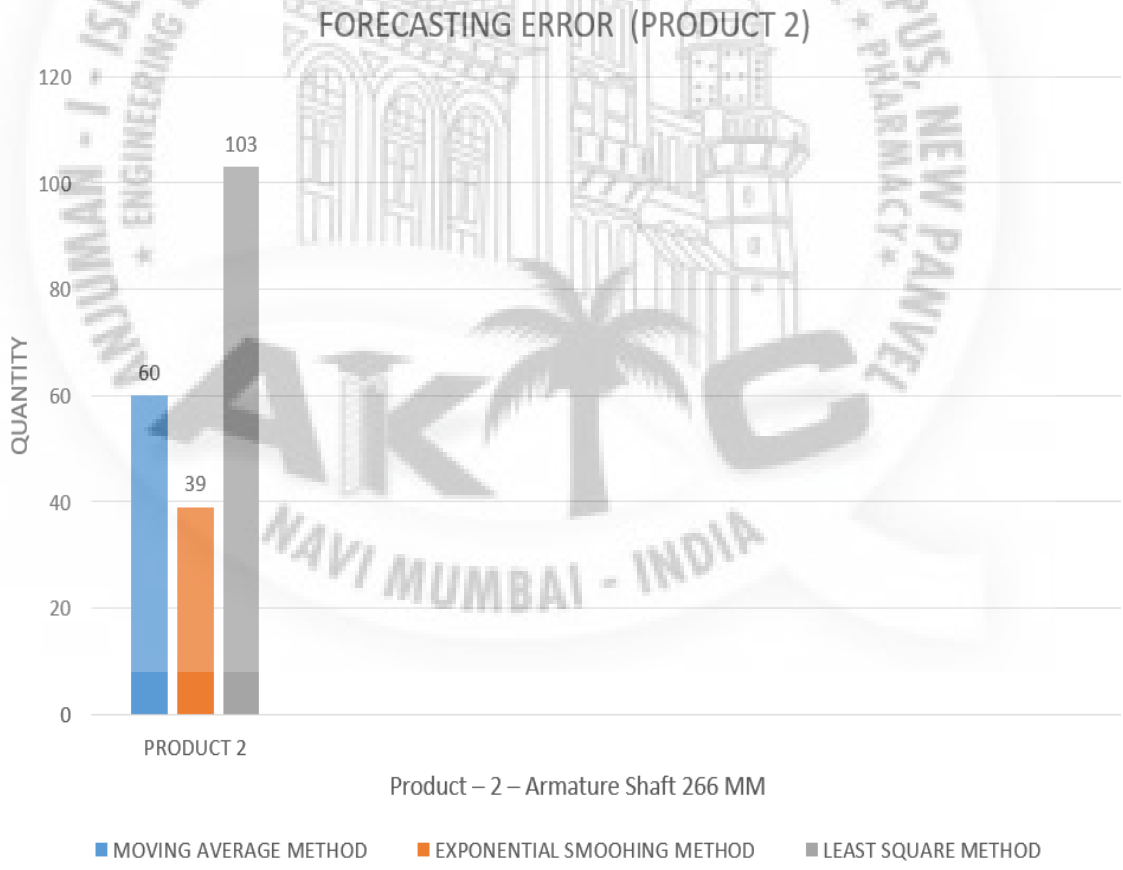


FIG: 6.3.2- Forecasting Error of Product-2 of all the three methods

➢ PRODUCT 3 – REDUCTION GEAR

1. MOVING AVERAGE METHOD :

Actual sales of the product is 11057 units.

Forecasted sales of the product is 11633 units.

FORECASTING ERROR = |11057 – 11633| = **576 UNITS**

2. EXPONENTIAL SMOOTHING METHOD :

Actual sales of the product is 11176 units.

Forecasted sales of the product is 11385 units.

FORECASTING ERROR = |11176 – 11385| = **209 UNITS**

3. LEAST SQUARE METHOD :

Actual sales of the product is 11280 units

Forecasted sales of the product is 12742units.

FORECASTING ERROR = |11280 – 12742| = **1462 UNITS.**

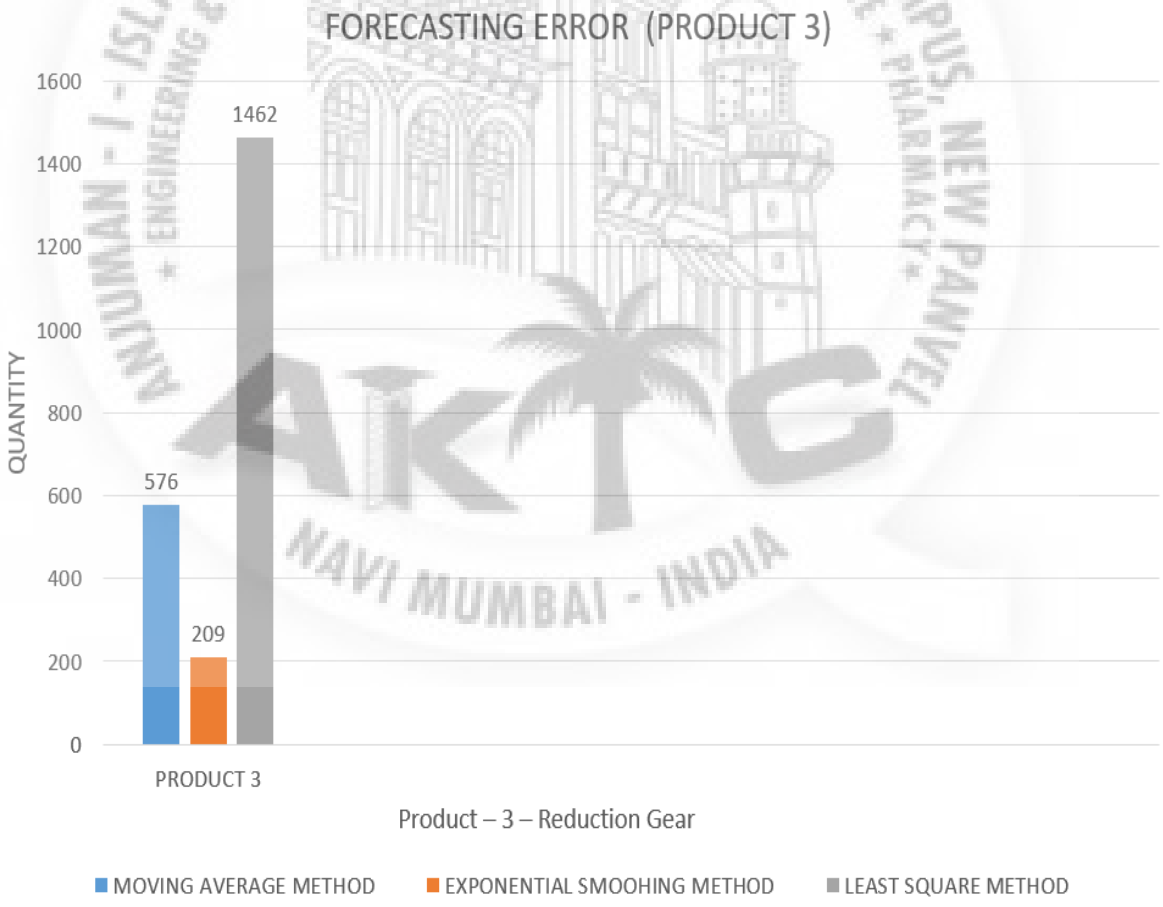


FIG: 6.3.3- Forecasting Error of Product-3 of the three methods

➢ PRODUCT 4 – HELICAL GEAR

1. MOVING AVERAGE METHOD :

Actual sales of the product is 11303 units.

Forecasted sales of the product is 14833 units.

FORECASTING ERROR = |11303 – 14833| = **3530 UNITS**

2. EXPONENTIAL SMOOTHING METHOD :

Actual sales of the product is 11095 units.

Forecasted sales of the product is 12134 units.

FORECASTING ERROR = |11095 – 12134| = **1039 UNITS**

3. LEAST SQUARE METHOD :

Actual sales of the product is 11318 units

Forecasted sales of the product is 15028 units.

FORECASTING ERROR = |11318 – 15028| = **3710 UNITS**

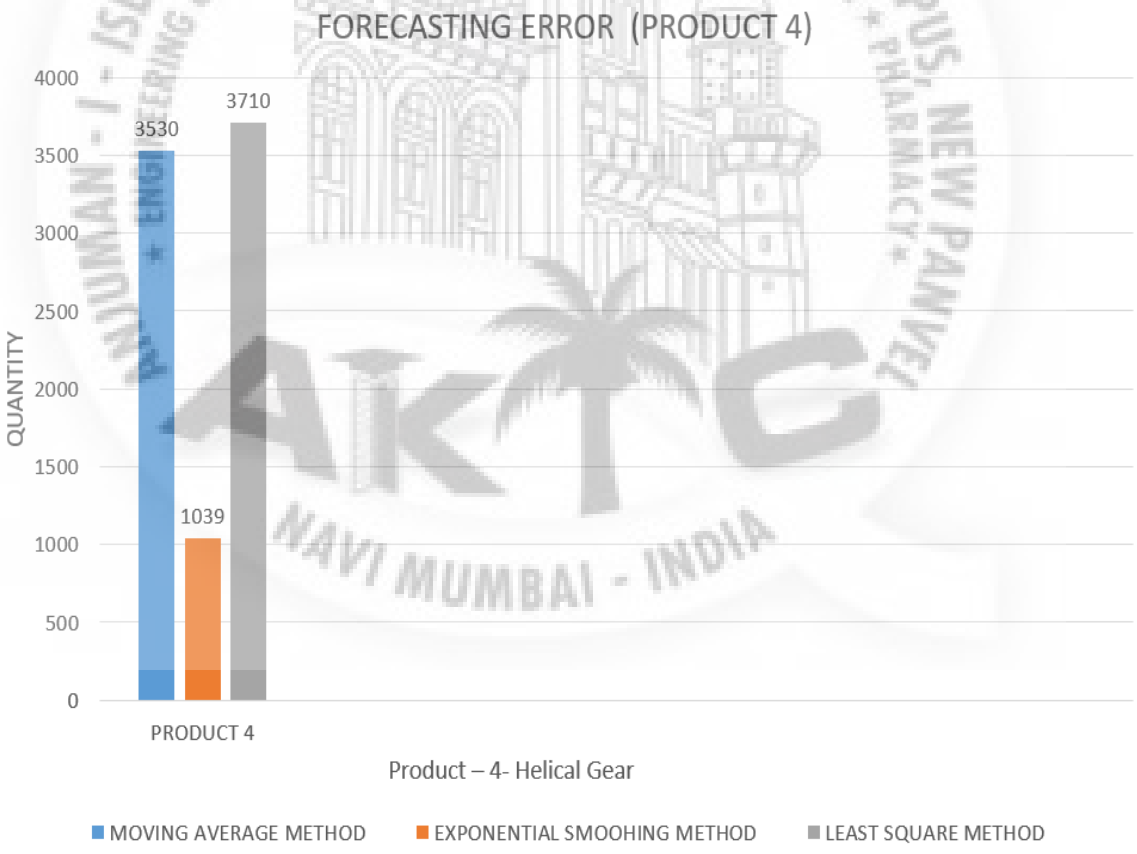


FIG: 6.3.4- Forecasting Error of Product-4 of all the three methods

➢ PRODUCT 5 – ARMATURE SHAFT

1. MOVING AVERAGE METHOD :

Actual sales of the product is 8139 units.

Forecasted sales of the product is 6500 units**.**

FORECASTING ERROR = |8139 – 6500| = **1639 UNITS**

2. EXPONENTIAL SMOOTHING METHOD :

Actual sales of the product is 8258 units.

Forecasted sales of the product is 8042 units.

FORECASTING ERROR = |8258 – 8042| = **216 UNITS**

3. LEAST SQUARE METHOD :

Actual sales of the product is 8203 units

Forecasted sales of the product is 7339 units.

FORECASTING ERROR = |8203 – 7339| = **864 UNITS**

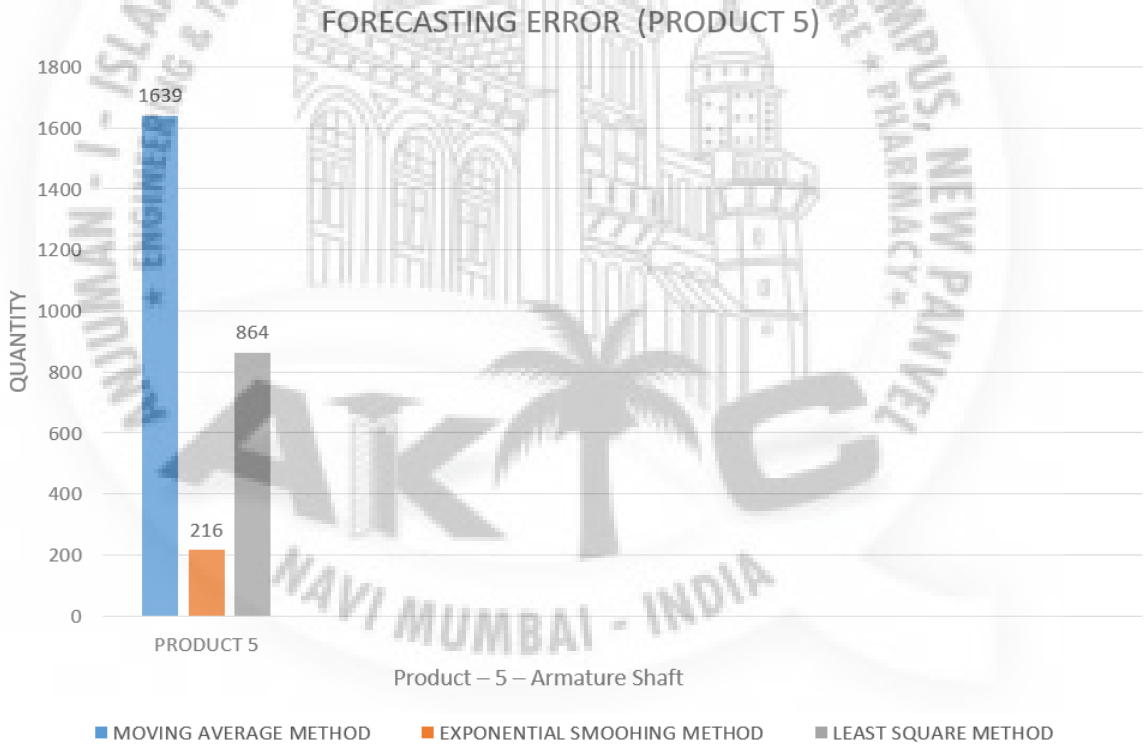


FIG: 6.3.5- Forecasting Error of Product-5 of all the three methods

From the above calculation for forecasting error of all the three methods, for all the five products it is clear that Exponential Smoothing Method gives less error as compare to other. So, **EXPONENTIAL SMOOTHING METHOD** is preferred for forecasting of sales of the product over others.

CHAPTER NO. 7: VALIDATION OF SOLUTION

QM FOR WINDOWS

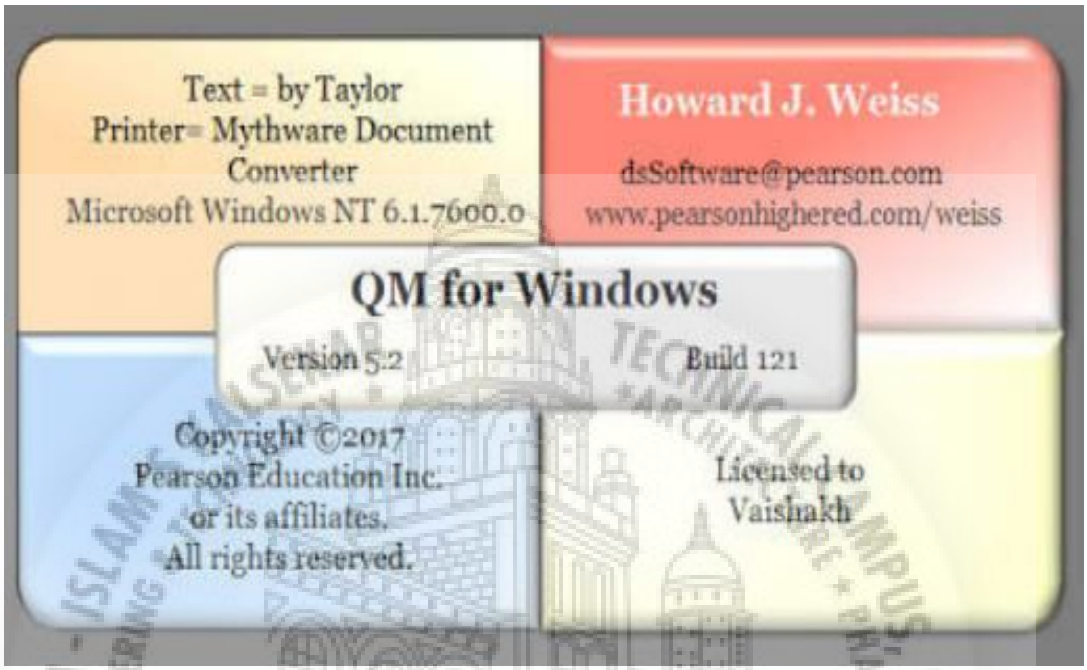


FIG – 7.A – QM FOR WINDOWS

FIG – 7.B - QM FOR WINDOWS

Comparing the theoretical method with the software method. In this, QM for windows [7] is the software which is used to compare the theoretical values with it.

➢ PRODUCT 1 – ARMATURE SHAFT WITH BALL ASSEMBLY

1. MOVING AVERAGE METHOD

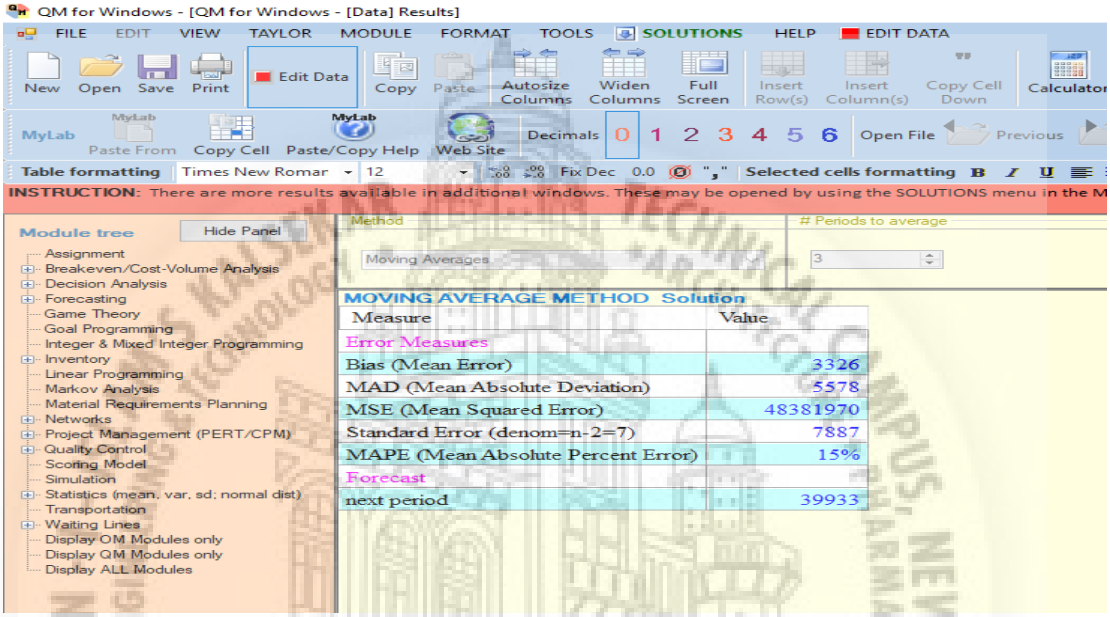


FIG – 7.1.1

2. EXPONENTIAL SMOOTHING METHOD

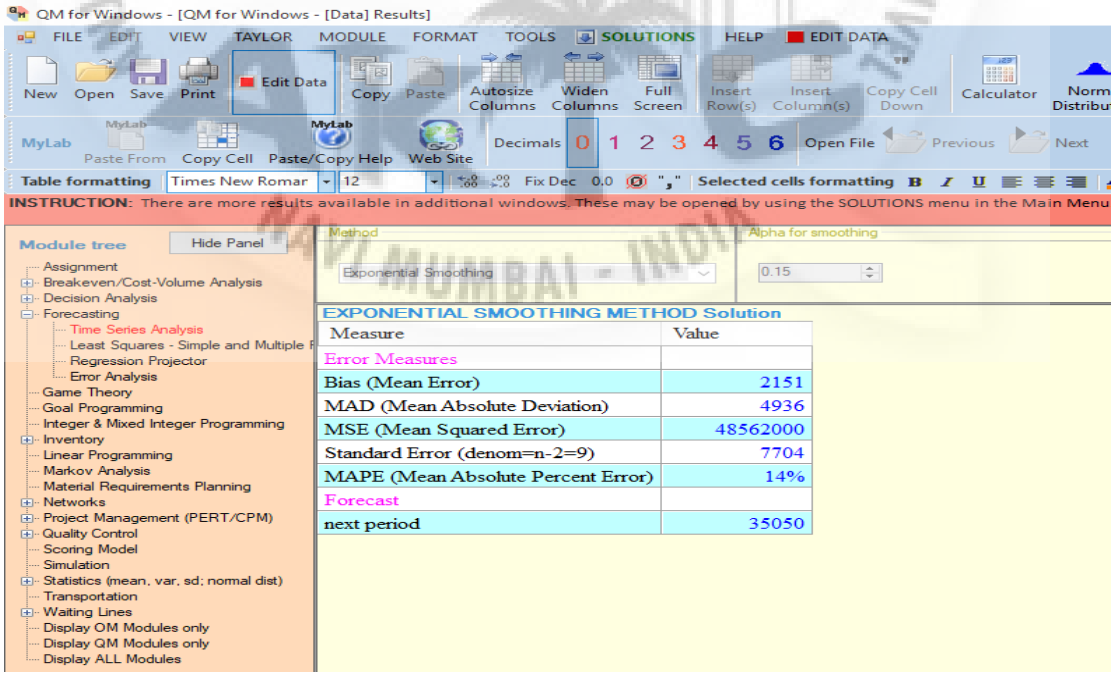


FIG – 7.1.2

3. LEAST SQUARE METHOD

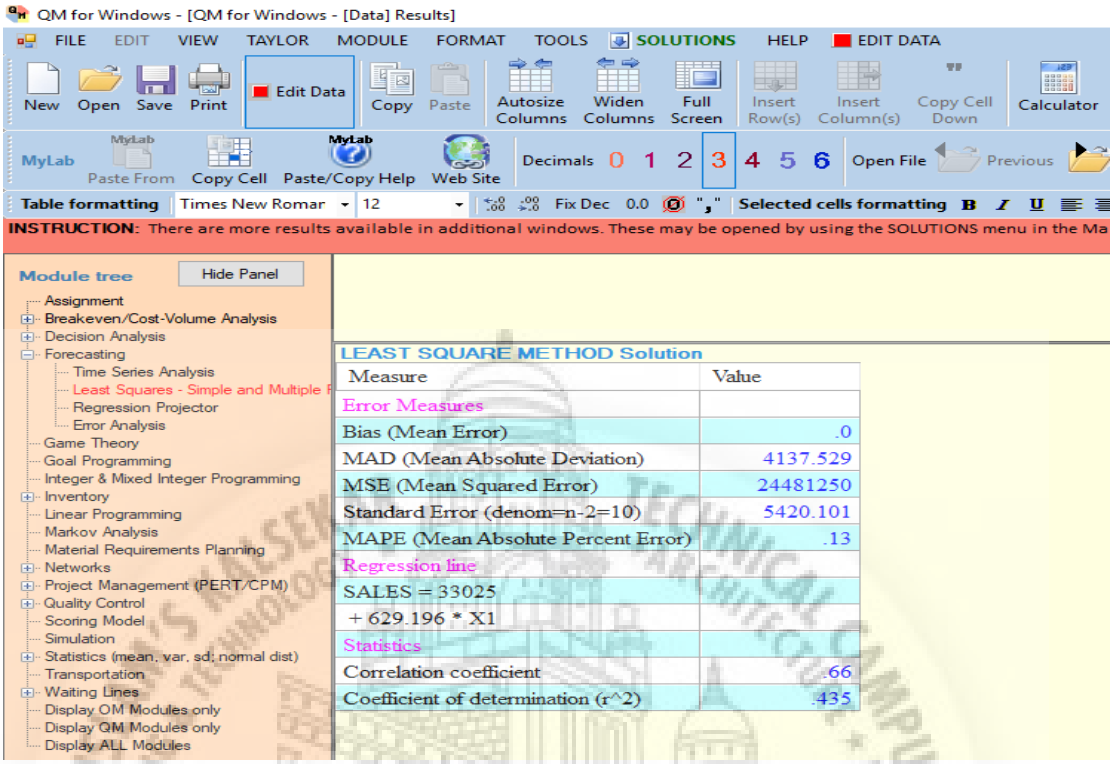


FIG – 7.1.3

➢ PRODUCT 2 – ARMATURE SHAFT WITH 266MM

1. MOVING AVERAGE METHOD

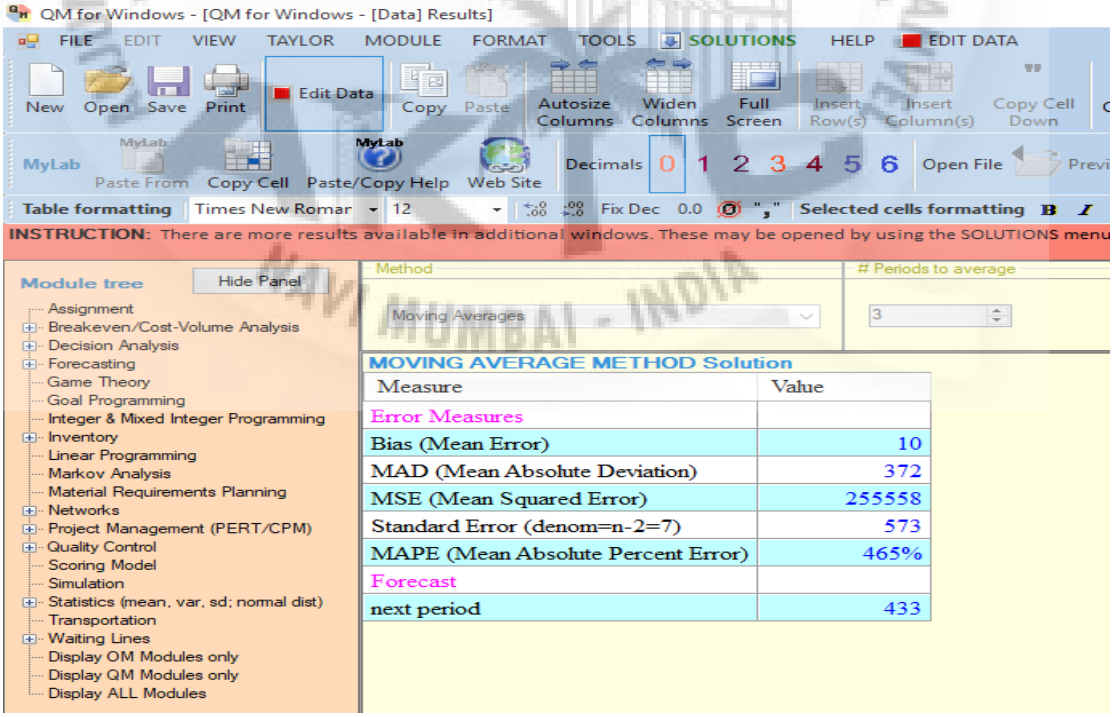


FIG – 7.2.1

2. EXPONENTIAL SMOOTHING METHOD

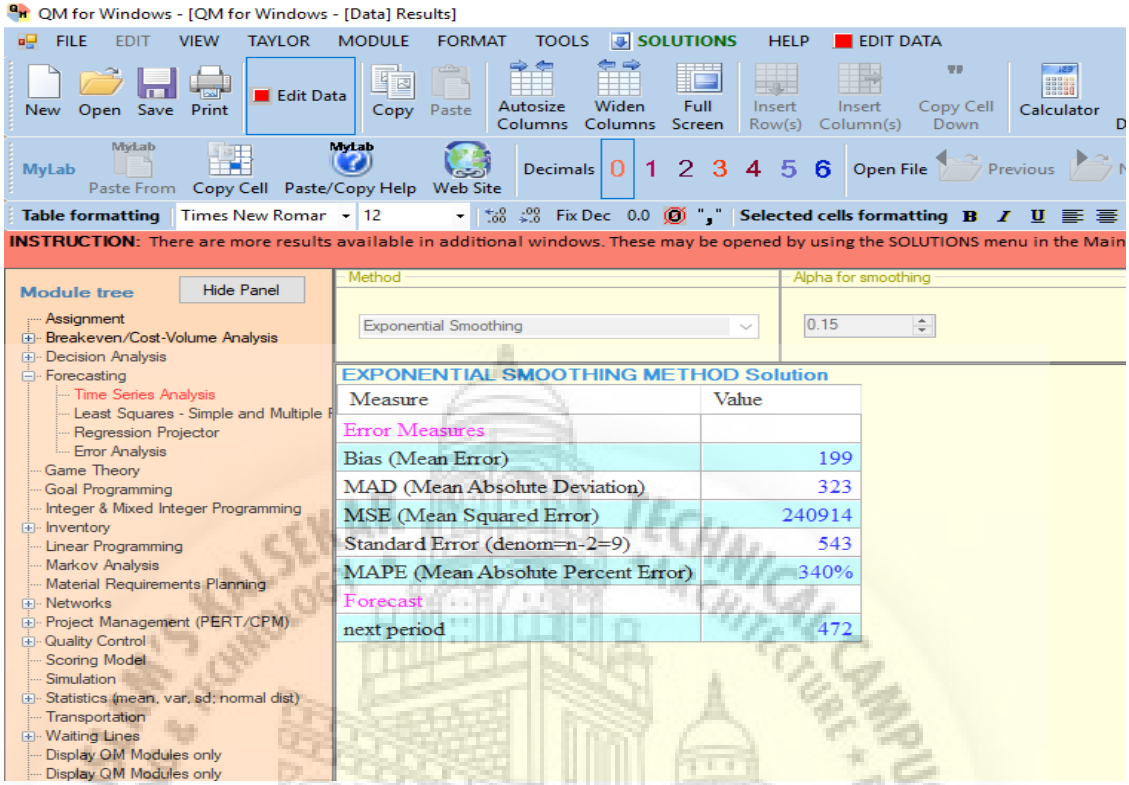


FIG – 7.2.2

3. LEAST SQUARE METHOD

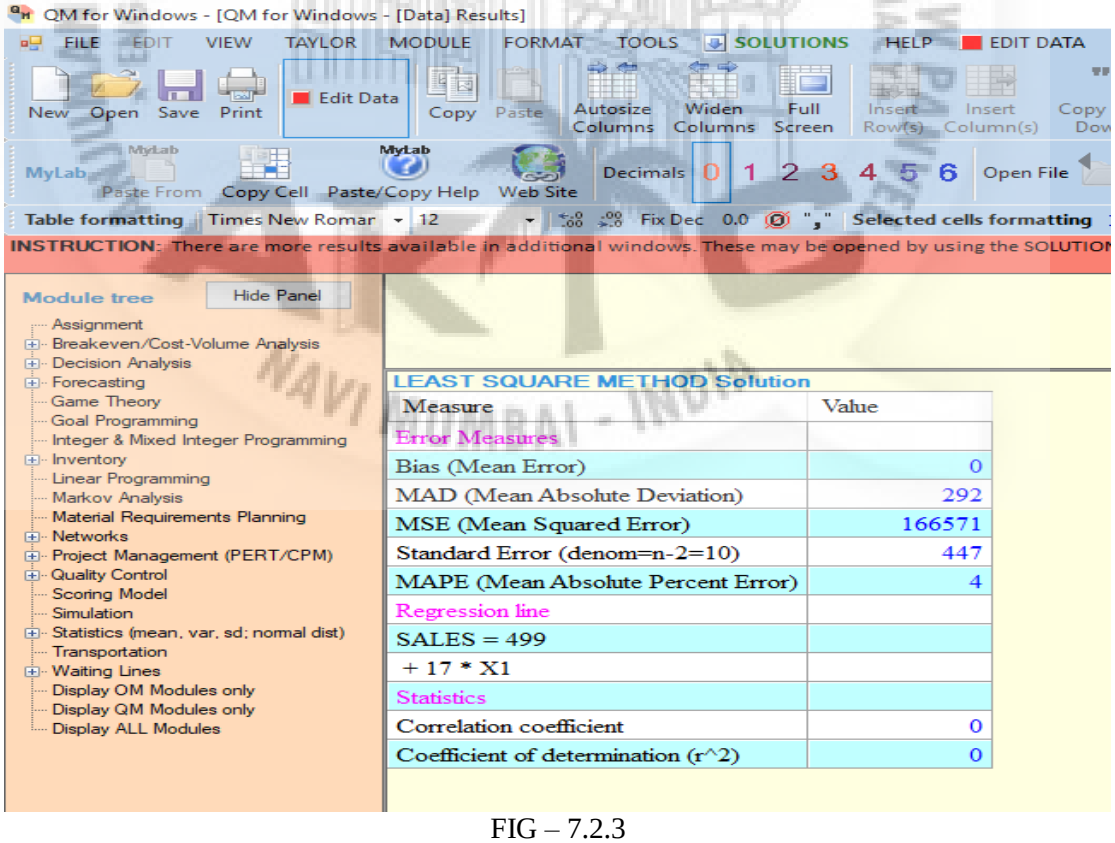


FIG – 7.2.3

➢ PRODUCT 3 – REDUCTION GEAR

1. MOVING AVERAGE METHOD

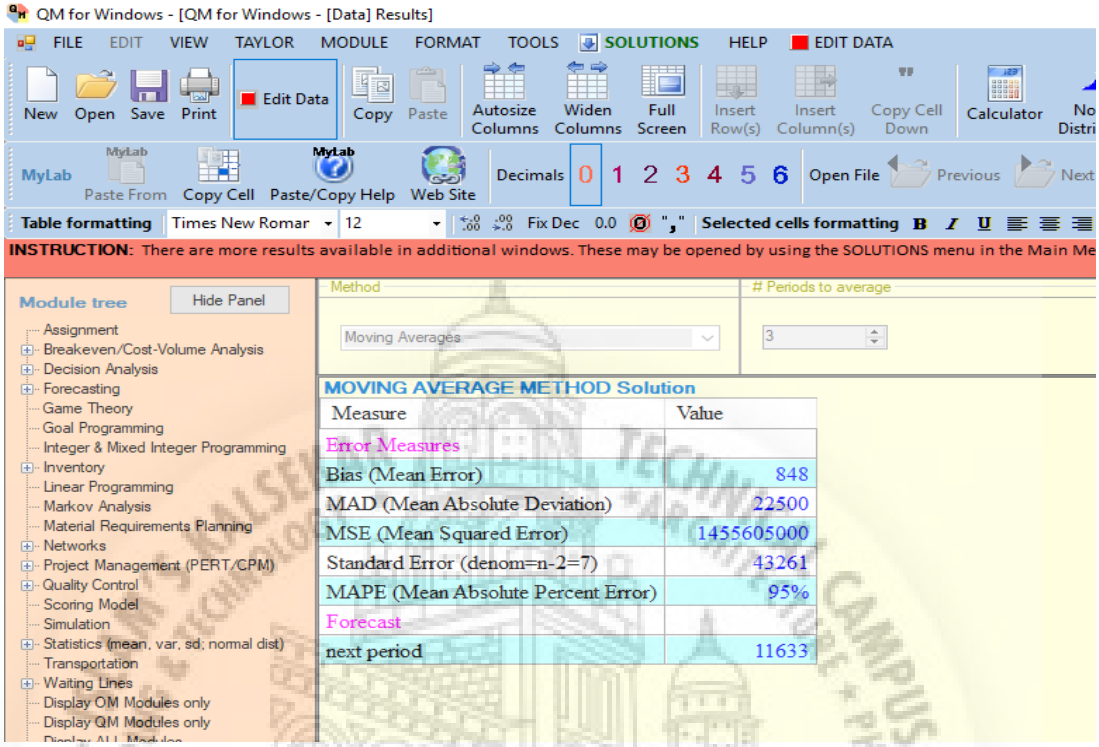


FIG – 7.3.1

2. EXPONENTIAL SMOOTHING METHOD

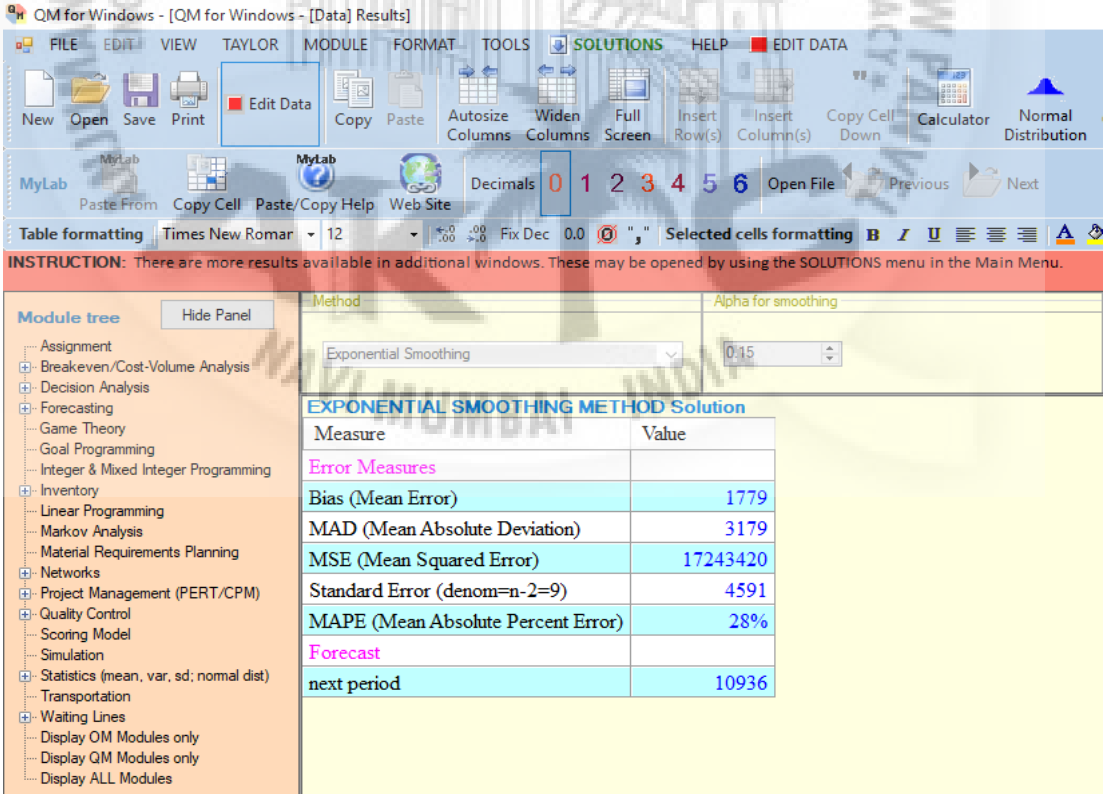


FIG – 7.3.2

3. LEAST SQUARE METHOD

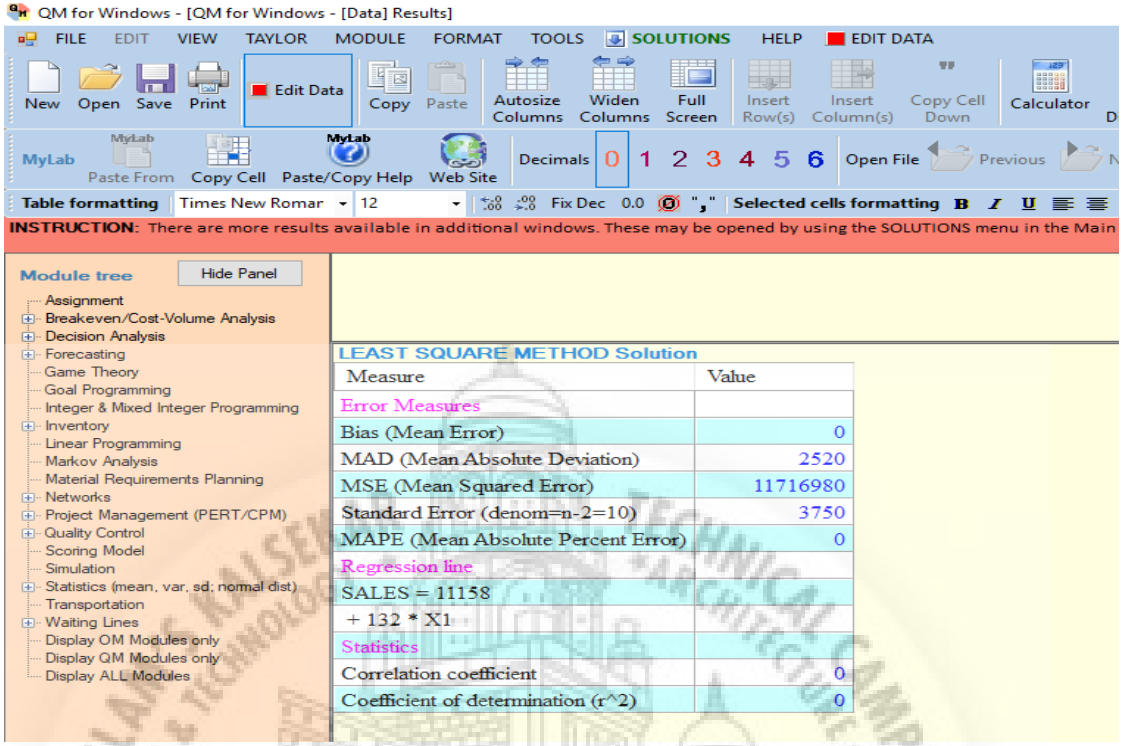


FIG – 7.3.3

➢ PRODUCT 4 – HELICAL GEAR

1. MOVING AVERAGE METHOD

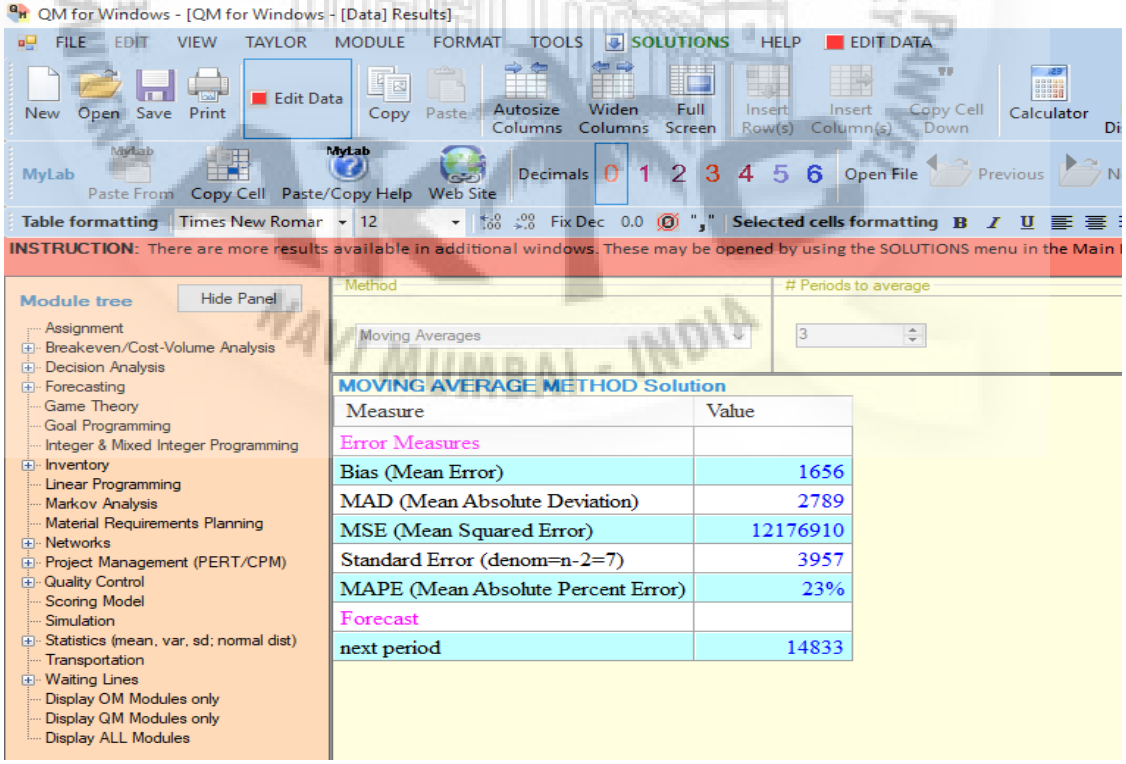


FIG – 7.4.1

2. EXPONENTIAL SMOOTHING METHOD

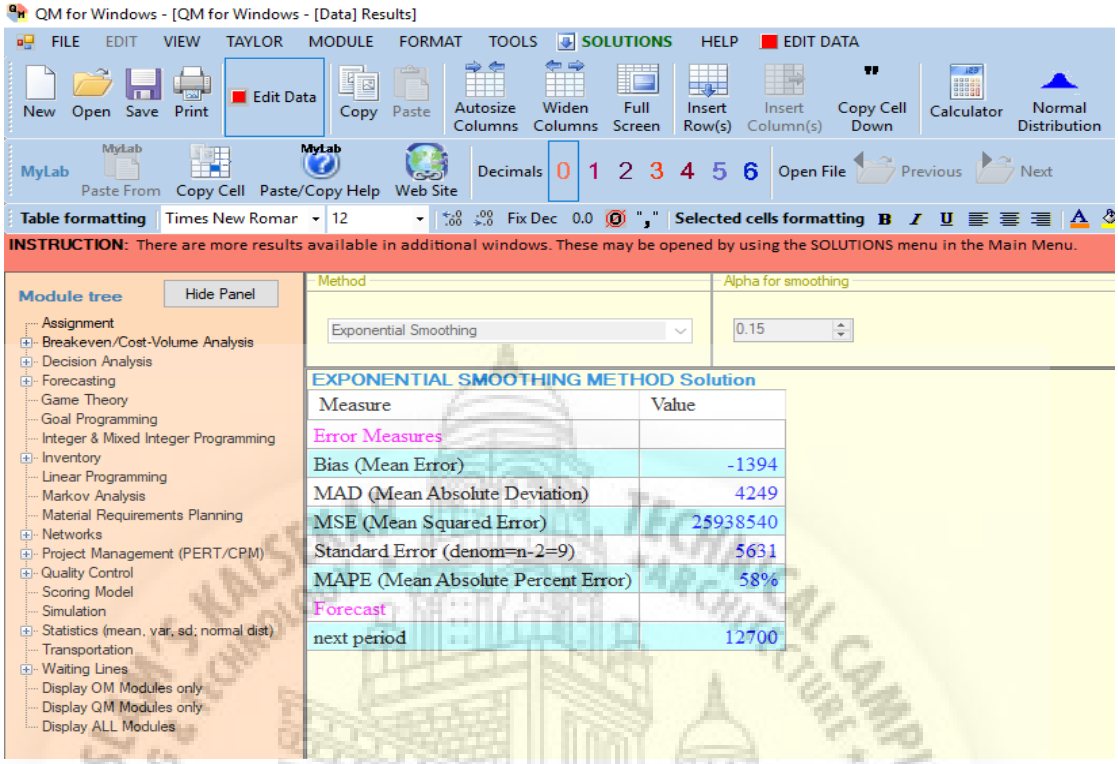


FIG – 7.4.2

3. LEAST SQUARE METHOD

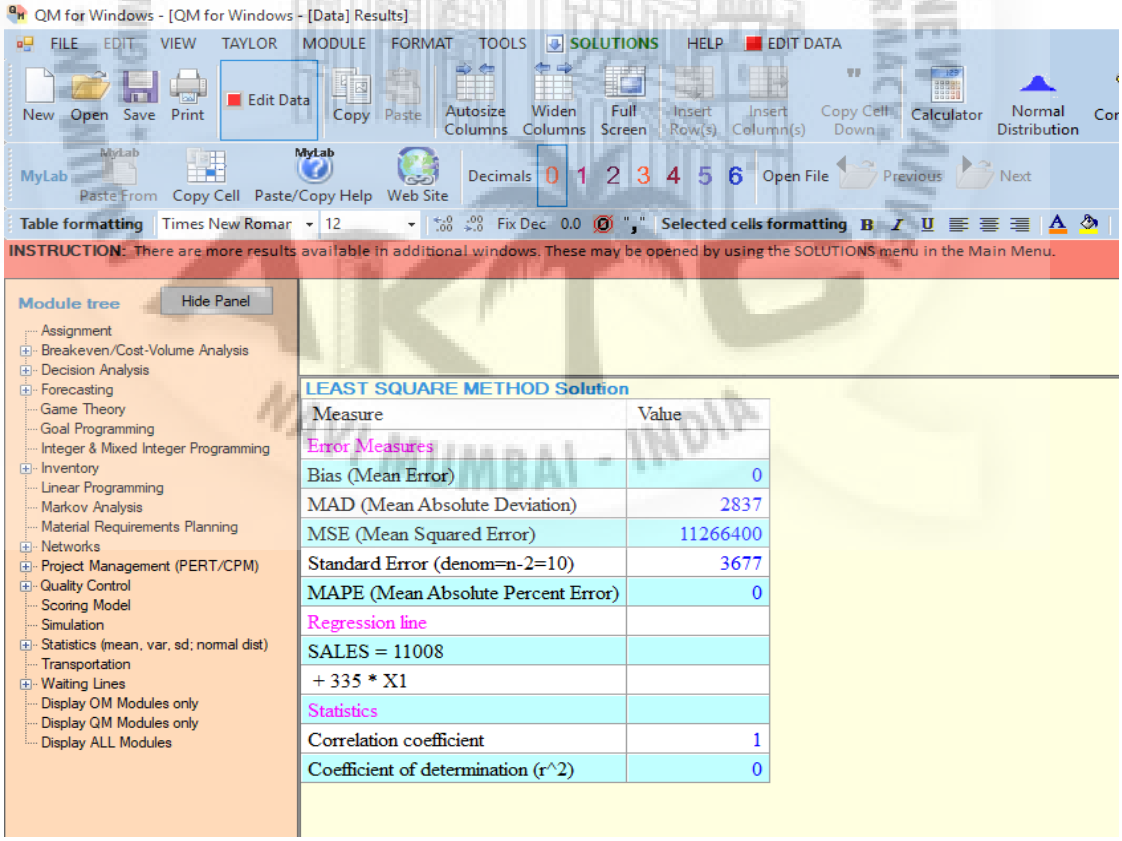


FIG – 7.4.3

➢ PRODUCT 5 – ARMATURE SHAFT

1. MOVING AVERAGE METHOD

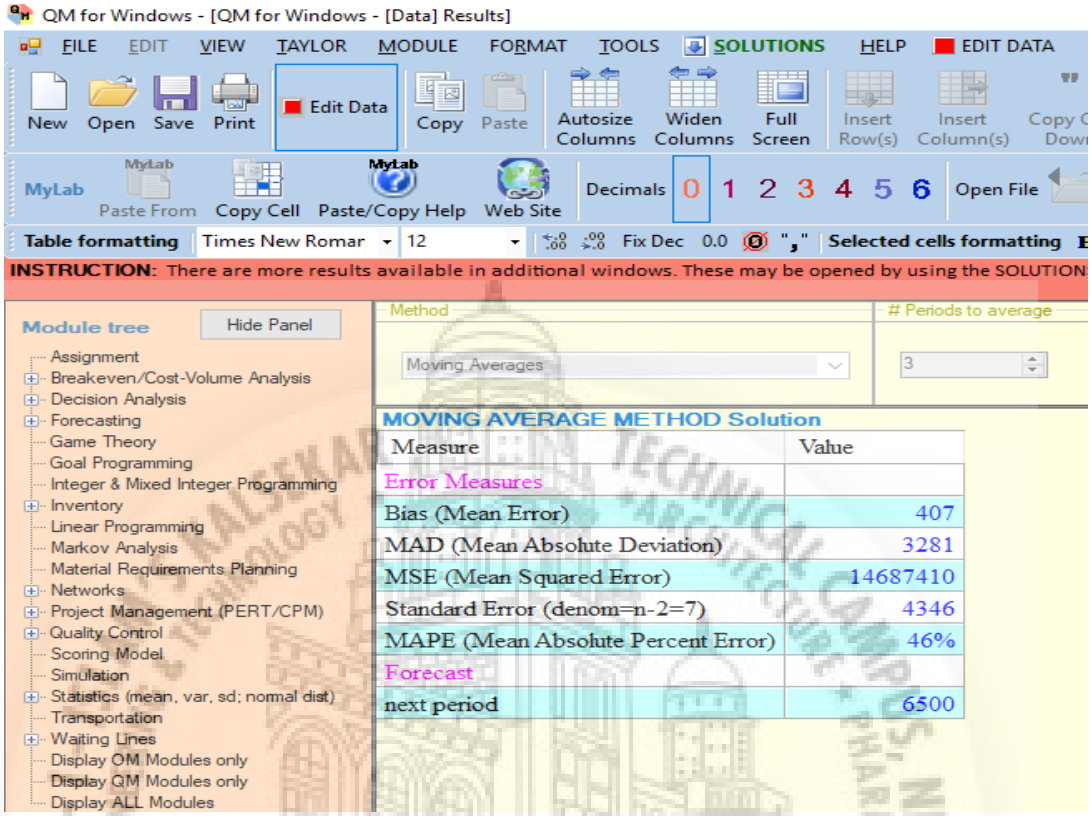


FIG – 7.5.1

2. EXPONENTIAL SMOOTHING METHOD

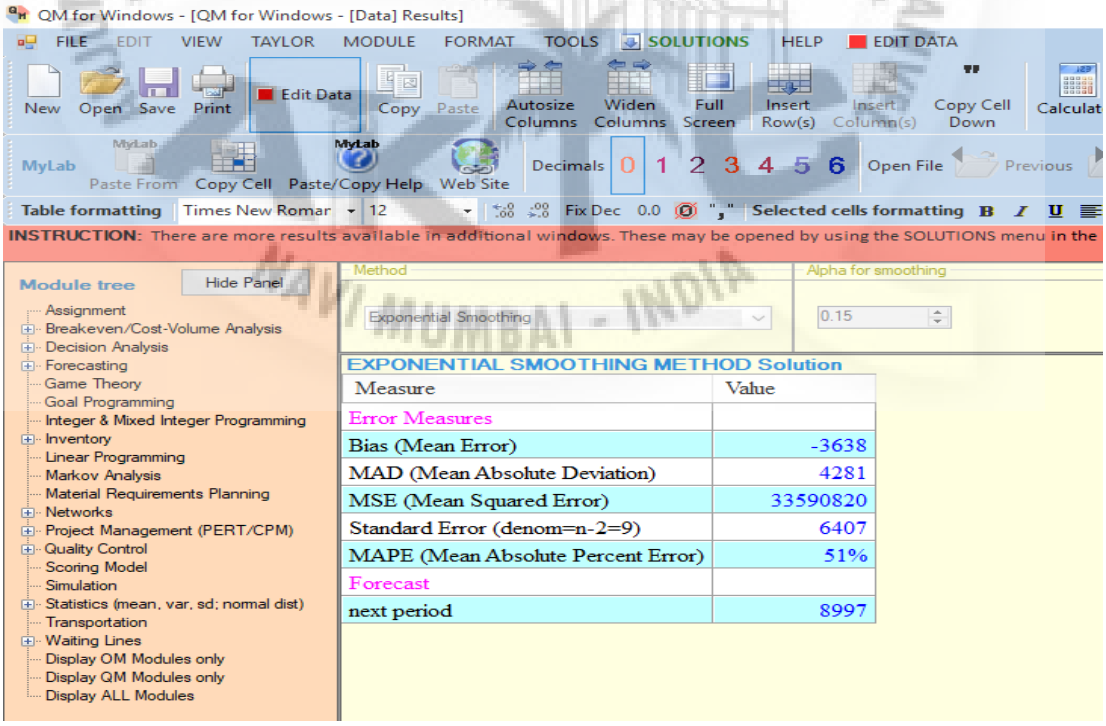


FIG – 7.5.2

3. LEAST SQUARE METHOD

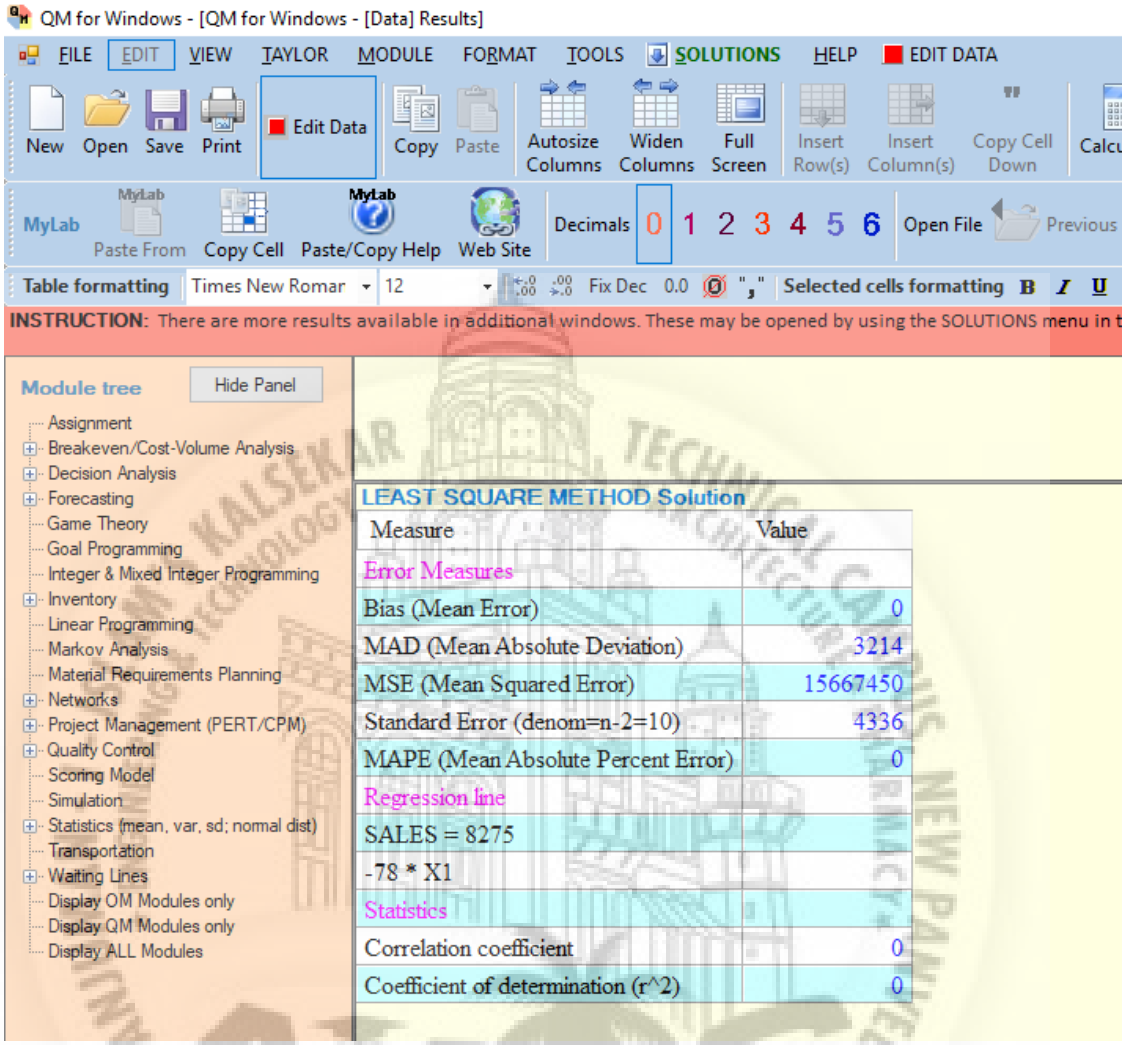


FIG – 7.5.3

By comparing the theoretical value with the software value we come to conclusion that all value of forecasting is same as theoretical except the exponential smoothing method because this software uses another method of finding forecasting sales that the error starts from the second month i.e. month of March, 18. The theoretical error starts from the first month i.e. month of April, 18.

CHAPTER NO. 8

CONCLUSION

In any manufacturing company the very important problem is the sales of the product. The production of the product should not be high than the sales of the product otherwise it will leads to quality of the product deterioration, warehousing of the product, etc. hence to avoid this sales planning is very important. Sales are forecasted and the production schedule will be planned accordingly. For the sales forecasting EXPONENTIAL SMOOTHING METHOD is best fit for the solution to the problem. The EXPONENTIAL SMOOTHING METHOD gives less error as compared to MOVING AVERAGE METHOD, LEAST SQUARE METHOD. This method will be proposed to the company **SUBHAM GEARS** for sales planning and according to that the production planning will be done. Based on this project process the inventory can be controlled and maintain it to optimum level.by doing this project we can make available the material, products at the right time and at the right time. Exponential smoothing is a rule of thumb technique for smoothing time series data using the exponential window function. Whereas in the simple moving average the past observations are weighted equally, exponential functions are used to assign exponentially decreasing weights over time. It is an easily learned and easily applied procedure for making some determination based on prior assumptions by the user, such as seasonality. Exponential smoothing is often used for analysis of time-series data.

EXPONENTIAL SMOOTHING METHOD

➢ PRODUCTION, SALES, INVENTORY DATA OF THE PRODUCTS BEFORE FORECASTING OF SALES

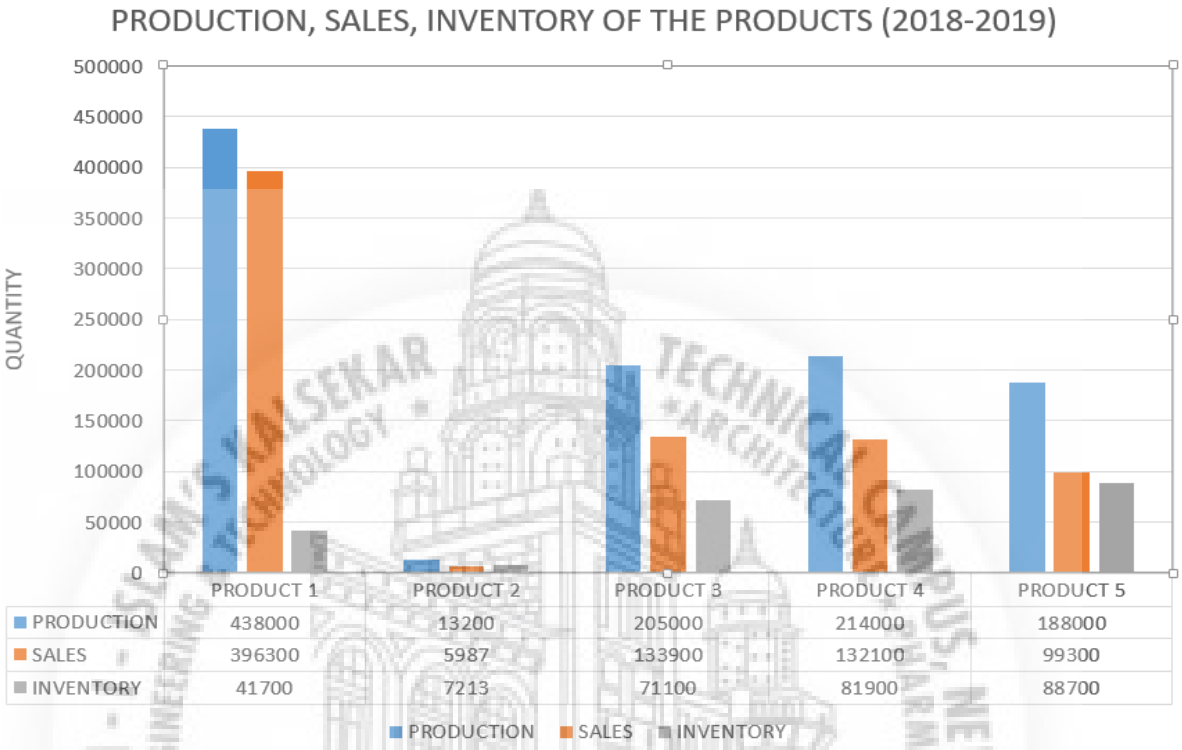


FIG: 8.1 – Production, Sales, Inventory data of the products before forecasting of sales

The above figure indicates the production of the products, sales of the products and according to that the products which are stored in the inventory. This data is when the forecasting of the sales methods are not used.

➢ PRODUCTION, SALES, INVENTORY DATA OF THE PRODUCTS AFTER FORECASTING OF SALES

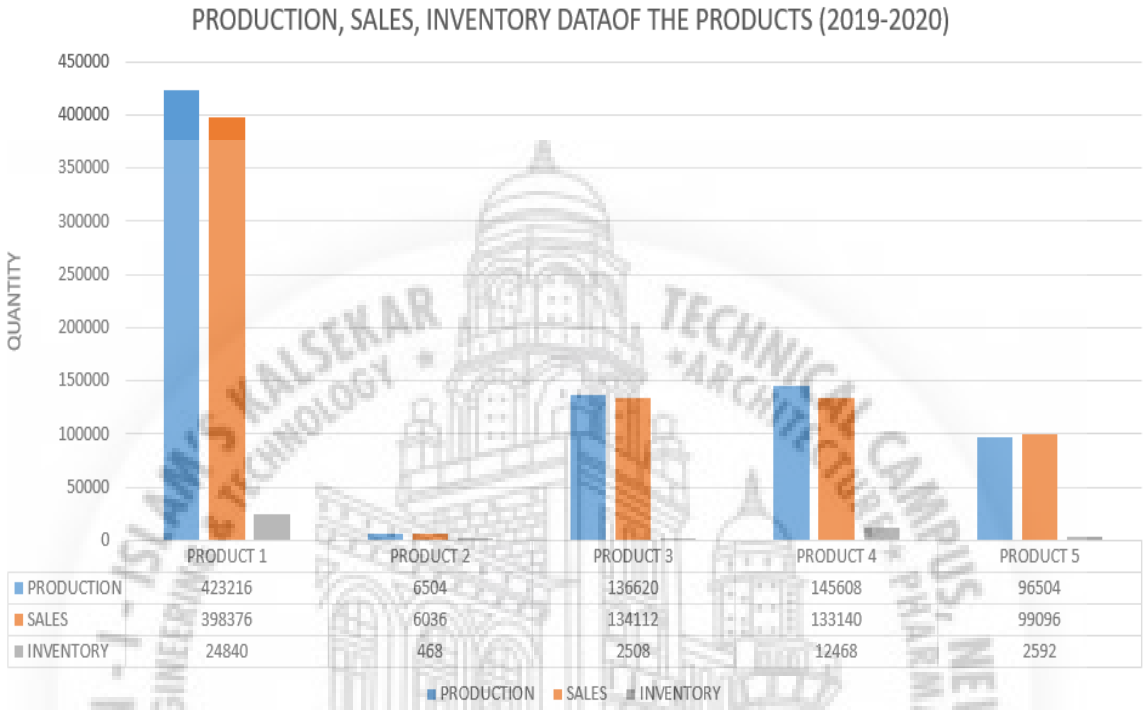


FIG: 8.2- Production, Sales, Inventory data of the products after forecasting of sales

The above figure indicates Production, Sales, Inventory data of the products after forecasting of sales. It is clearly seen that by using the exponential smoothing method of forecasting of sales the inventory level is maintained up to the moderate level neither the products are more in the inventory nor the products are less in inventory and also the sales of the products are maintained to increase the turnover of the company.

*Note: The above data of production, sales, inventory is assume that the sales, production of the product will be constant throughout the year for (2019-2020). So after calculating the sales, and the production of all the five products by exponential smoothing method then multiple the production, sales value by 12. Since there are 12 months in one year. The company will manufacture or produce the same amount of product as forecasted.

CHAPTER NO. 9

FUTURE SCOPE OF THE PROJECT

Automation is a technology concerned with this application of Mechanical, Electronics and Telecommunication and Computer based systems to operate and control production. This system is used to operate the sales planning automatically by using ARTIFICIAL NEURAL NETWORK. This project may be developed with fully utilization of men, machine and materials and money. Also we have followed thoroughly the study of time motion and made our project economical and efficient with the available resources. This system is designed and tested successfully by using software QM for windows. We hope that this will be done among the most versatile and interchangeable one even in future. Thus we can able to obtain automatic sales forecasting equipment such as ARTIFICIAL NEURAL NETWORK.

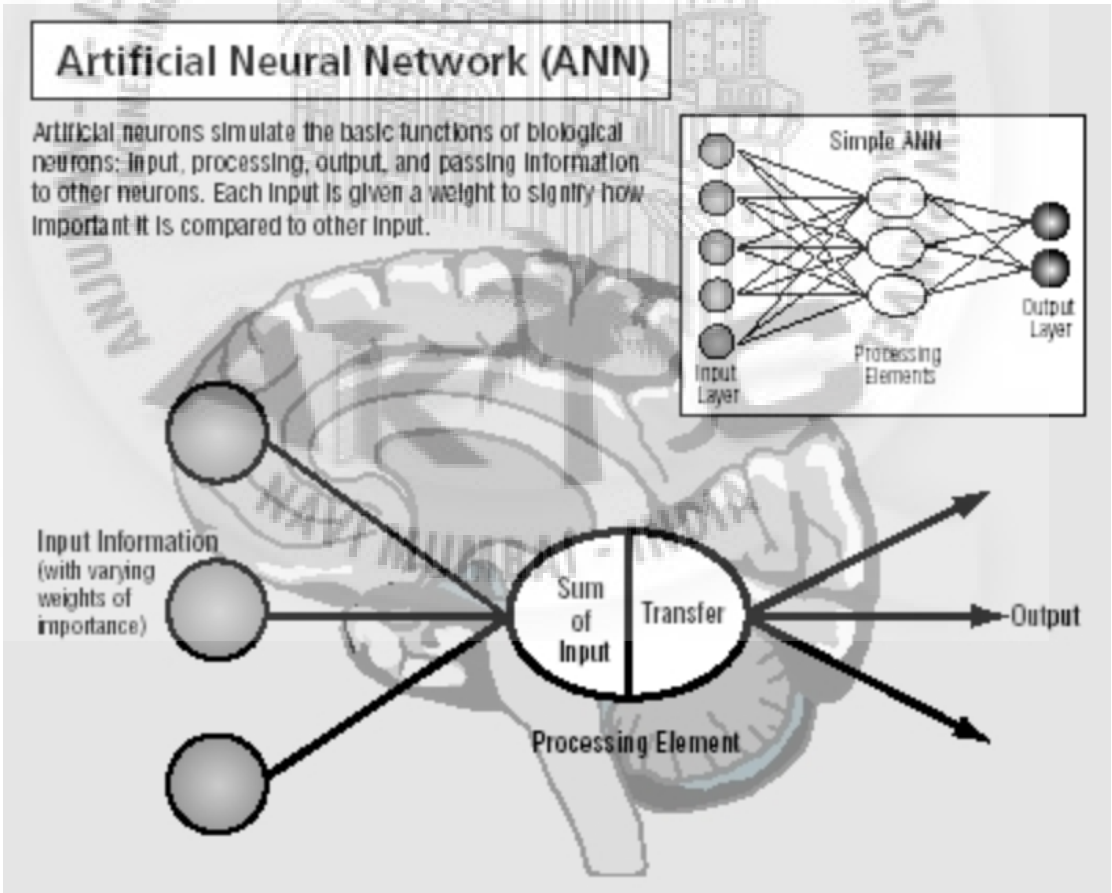


FIG – 9.1 – ARTIFICIAL NEURAL NETWORK [6]

CHAPTER NO. 10 – BIBLOGRAPHY

[1] **PRODUCTION PLANNING AND CONTROL** –

DR. Mohd. Asif Gandhi – FORECASTING (NOTES)

BOOKS:

[2] Srikrishna, "**PRODUCTION PLANNING AND CONTROL",** 4th Edition, Bengaluru, pp. 30- 68.

[3] Martand Telsang**, "INDUSTRIAL ENGINEERING AND PRODUCTION MANAGEMENT",** 1st Edition, 1998, Reprint 2010, Maharashtra, pp. 210

- Er. Prem Kumar Gupta, "**OPERATIONS RESEARCH**", 7th Edition, 2014, Delhi, pp. 1164.
- S. Anil Kumar | N. Suresh, "**PRODUCTION AND OPERATION MANAGEMENT**", 2ND Edition,

WEBSITES

[4] www.slideshare.net

[5] www.scribd.com

[6] Medium.com

[7] Youtube.com – Ayu zamani (video)

[8] Saleshacker.com

[9] Acountlearning.com

[10] ng.oberlo.com

[11] financialexpress.com

[12] scdigest.com

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APPENDIX

- LIST OF TABLES

➢ LIST OF FIGURES