Implementation of Inventory Management System in a Furniture Company: A Real Case study

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ABSTRACT

Inventory management system for any company is essential to fulfil customer demands on time and in cost effective manner. Selection and implementation of inventory management system for any company management is vital. In this paper, we will discuss the most commonly used inventory management tools and using a real furniture company data as a case study, we will implement the inventory management system. In last, we will compare the implemented inventory management system with the existing system and infer the results.

Keywords: *Inventory Management system, EOQ, MRP, Forecasting Methods, Inventory Cost*

1. INTRODUCTION

The industries implementing improved forecasting systems to make the production planning process more efficient. Due to the complex nature of this task the companies designate a special unit to perform the forecasting tasks by using statistical software systems. In fact, in today's world the companies are in strict competition and are improving businesses by making supply chain management as much efficient as possible. The industrial sector has to take forecasting decisions by considering uncertainties which can affect the overall production, for example a reduced market demand for a particular product over a certain time period could easily disturb the forecasting [1]. To deal with this situation every company has a continuous reviewing process in order to scrutinize the current market economic environment. In common practice usually the marketing, sales and operations departments work out the initial forecasting figures according to the demand and production capacity and later on judgmental adjustments are implemented to achieve the optimum production and inventory levels. Many researchers have been implemented several models to deal with uncertainty during production planning process [1, 7]. Researchers also used different linear programming models to solve multi-period procurement lot-sizing problems and found it suitable in determining the feasible lot size to decrease the purchasing cost, transportation cost, shortage cost and inventory cost [2].

Material Requirement Planning (MRP) based on procurement lot sizing decisions according to the demand over a finite time period. If the demands are known over a time horizon then a static Economic Order Quantity (EOQ) model can generate feasible and optimum solutions [2]. The companies apply EOQ models by determining the economic ordering lot size to reduce the ordering and holding cost. Also, the Economic Production

Quantity (EPQ) applies to minimize the manufacturing setup and finished products holding cost by deciding the economic manufacturing batch size [3].

Over the years, the researchers have used different methods to compare the performance of forecasting methods across different time series by mean squared error (MSE), root mean square error (RMSE), mean absolute deviation (MAD), mean absolute error (MAE) and mean absolute percentage error (MAPE) [7-13]. However, every method has some limitations and user has to be aware of limitations before using it for forecasting. This paper is consisting of a case study in a furnisher manufacturing company based on the forecasting.

2. LITERATURE REVIEW

In 2007, Mula et al [1] managed to find out a fact that the uncertainties with fuzziness and lack of knowledge or epistemic uncertainty can be modelled with fuzzy constraints and coefficients. This work proposed a new fuzzy mathematical programming model that provided a possibilistic modelling approach tested with an automobile seat assembler and compared with other fuzzy mathematical programming approaches. The proposed model is useful in determining the master production schedule, MRP, stock levels, demand backlog and capacity levels for a given production planning. The good feature of this work is the proposed model that actually considers the uncertainties with the lack of knowledge in data and existent fuzziness collectively during production planning. Though researchers worked on these two types of uncertainties but no one considered them jointly at the same time.

Davendra et al [2] used integer linear programming to solve the problem of multi-period procurement lot-sizing for single

product and single supplier with rejections and late delivery performance under all-unit quantity discount environment. The developed mathematical model first established the cost objectives such as purchasing cost, ordering and transportation cost, inventory cost to determine the appropriate lot size and its timing to minimize the total cost during the decision horizon and then it scrutinized the differences in rejection rates, demand, storage capacity and inventory holding cost on total cost. The proposed model in this work can be used in MRP in realistic situations and can solve the problems with reasonable size but if the number of quantity levels or periods increases the proposed mathematical model could become densely populated with large number of binary variables and make the model computationally complex or non-interactive.

Banerjee [3] proposed an IVB (Integrated vendor-buyer) system in which the demand rate was constant from the buyer and manufacturer had to produce the same amount of inventory levels as the buyer demanded. But this model doesn't fit when the manufacturer's production setup cost is bigger then the buyer's ordering cost. However, many researchers evaluated and developed IVB systems in order to make it optimal for single-vendor single-buyer problem. Another model that incorporates raw material procurement and manufacturing setup is called IPP (Integrated procurement-production) in which Jamal and Sarker [4] worked out the optimise batch size for just-in-time delivery based production system. Sarker and Parija [5] developed optimum batch size and raw material ordering policy for production systems with fixed-interval and lumpy demand delivery system. Lee [6] highlighted the fact that no one had discussed the IPP system takes buyer's ordering quantity and inventory holding cost into consideration and proposed a Joint Economic Lot Size (JELS) of manufacturer's raw material ordering, production batch and buyer's ordering that was based on an integrated inventory control model involved IVB and IPP systems together.

Since demand forecasting is an imperative stage of planning and most of the organisations are using computerised forecasting systems to generate early forecasts and then incorporate judgemental adjustments at later stages. Robert et al [7] investigated whether the judgemental adjustments in forecasting made forecasting more effective and improve accuracy. They collected more than 60,000 forecasting data from four supply chain companies and found that the bigger adjustments brought more average improvements in accuracy then the smaller adjustments. Furthermore, the positive adjustments (adjusting the forecast upwards) were less effective in improving the accuracy then the negative adjustments.
In 1999, Paul et al [8] reported that the researchers advised not to use mean absolute percentage error (MAPE) in the measurement of forecast accuracy because it was considered asymmetric in that 'equal errors above the actual value result in a greater APE than those below the actual value [9]'. Armstrong and Collopy [10] also agreed that the MAPE treated errors in the forecast higher than the actual observation differently from those less than this value. In order to rectify this error, Paul et al [8] proposed a symmetric MAPE but it was

observed that it treated negative and positive errors mainly if the errors had large absolute values far from the symmetric. Hence the authors were concerned on the proposed MAPE in its treatment with large positive and negative errors. In another development, Mathews et al [11] also quoted that no single measure provides definite suggestion of forecasting performance, though the use of multiple measures can create the comparisons between forecasting methods difficult and unmanageable.

Since mean absolute error (MAE), root mean square error (RMSE) and mean absolute percentage error (MAPE) are usually applied for estimating the forecast performance of a time series model, Naveen et al [10] suggested a bootstrap test procedure of mean absolute errors of two alternative time series models and similar results were observed after comparison with Sign test and DM test. The proposed bootstrap did not depend on particular distributional assumptions.

In 2002, a case study was published in which Everette and Joaquin [13] analysed the methods to adjust seasonal demand series in inventory at a large auto parts distributor. Simple procedures were developed to identify seasonal adjustments with an additive decomposition procedure that can provide considerable decline in forecast errors and safety stock investment. The company was not interested in forecast summary errors found in empirical research. However, they were interested to learn how seasonal adjustments produced affects in inventory performance. The authors estimated the aggregate MAD of forecast errors at each distribution centre and any decline in MAD would reduce the safety stock investment without affecting customer service.

Based on the above mentioned literature review, we can clearly identify the importance of proper inventory management system. Based on this contemplation, the remainder of this study is organized as follows: Section 3 discusses the methodology and analyses the results. Finally, Section 4 draws conclusions.

3. METHODOLOGY

3.1 Company Introduction

XYZ Furniture Company stands as a company for school furniture with tradition and modernity, which has made a history. The Company has 110 successful years with many significant contributions in the development of school furniture. They serve the entire region with the same exceptional quality, function and service. The company has established a process-orientated quality-management system based on the new standard DIN EN ISO 9001:2000. They provide ergonomic furniture for "school of the future", including flexible movable seating, height-adjustable desks and versatile, easy-to-reposition work surfaces, flexible room utilization. Different chairs and other furniture products are used for analysis in this paper in the following table 1 but the names of the products

have been changed from specific to common due to the company policy.

Table I

S. No.	Product Names
1	Chairs without armrest
2	Class room chairs
3	Front desk chairs
4	Waiting area chairs
5	Revolving Chairs

Table 1 shows selected names for the products.

3.2 Current System Analysis

3.2.1 Data Analysis

The make-up of inventory solutions needs a deep look for the previous historical data in order to assess the current inventory performance, and gain the knowledge to develop the exact area of weakness. The following data was received from the company;

o **Working Days:** The company has 280 working days per year. They are working one shift/9.5 hrs/day.

o **Lead Time:** The elapsed time between sending the purchasing order to Germany and receiving the material in XYZ Furniture Company store is eight weeks. The eight weeks divided as follow;

> One week for sending the purchase request to Germany, this includes:

- Negotiations for rates, delivery dates, shipping volume.
- All related mailing and documentation procedures.

> Seven weeks till receiving the material this includes:

- Production.
- Purchasing material.
- Arrangement for containers.
- Loading & packing.
- Transportation by sea from Germany.
- Clearance in UAE.
- Transportation from Jabal Ali Port to XYZ FURNITURE COMPANY in Sharjah.

o **Backorder:** The backorder rate for furniture in the company is around 10%. The main reasons of this back order rate are:

- The unexpected customer orders that contains German parts with big quantities and cannot be covered by the stock at that time.
- The unexpected customer order after sending the purchase request to Germany.

o **Turn Over Rate:** The current turnover was calculated, the result is illustrated in Figure 1
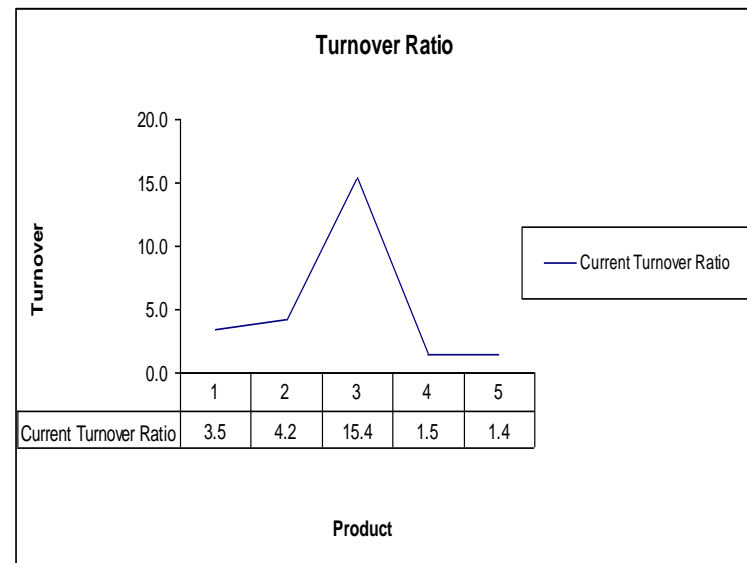

	1	2	3	4	5
Current Turnover Ratio	3.5	4.2	15.4	1.5	1.4

Figure 1: Current Turnover Ratio

o **Inventory Model:**

The company is using the pipeline system for managing inventory.

o **Safety Stock:**

The company is keeping 15 % of inventory as safety stock.

3.2.2 Proposed Model

For the purpose of improving the inventory management system, two models were developed:

1) Economic Order Quantity system (EOQ).
2) Material Requirement Planning (MRP).

These models were applied on five main products: Chairs without armrest, class room chairs, front desk chairs, waiting area chairs and revolving chairs.

Forecasting was used as an input to these models, different types of forecasting methods were used which are: two weighted moving average, three weighted moving average, exponential smoothing and double exponential smoothing. The last two methods were constructed using different values of smoothing constant α. The forecast results were evaluated using common accuracy measures: MAD, MSE, and MAPE. Based on the accuracy measures the most accurate method was assigned for each product, the remaining methods are shown in Appendix (1). The results of evaluating the accuracy of each product are illustrated as follow:

3.2.2.1 Chairs without armrest
3.2.2.1.1 Forecast

To evaluate the best forecast method to apply, accuracy measurements were calculated for each method. Table 2 shows the accuracy measures for chairs without armrest.

Smoothing Constant	Accuracy Measure/Method	Exponential Smoothing	Double Exponential Smoothing	Weighted MA(2)	Weighted MA(3)
Alpha (α) = 0.1	MAD	388.011	391.465	353.578	324.644
Beta (β) = 0.15	MSE	320323.126	285141.746	304579.022	253638.732
	MAPE	29.700	32.432	24.584	25.272
Smoothing Constant	Accuracy Measure/Method	Exponential Smoothing	Double Exponential Smoothing	Weighted MA(2)	Weighted MA(3)
Alpha (α) = 0.15	MAD	392.694	403.6764	353.578	324.644
Beta (β) = 0.15	MSE	320535.475	302051.428	304579.022	253638.732
	MAPE	31.541	36.391	24.584	25.272
Smoothing Constant	Accuracy Measure/Method	Exponential Smoothing	Double Exponential Smoothing	Weighted MA(2)	Weighted MA(3)
Alpha (α) = 0.2	MAD	399.10	416.911	353.578	324.644
Beta (β) = 0.15	MSE	325571.985	319158.8494	304579.0228	253638.732
	MAPE	33.269	38.083	24.584	25.272
Smoothing Constant	Accuracy Measure/Method	Exponential Smoothing	Double Exponential Smoothing	Weighted MA(2)	Weighted MA(3)
Alpha (α) = 0.3	MAD	417.505	444.685	353.578	324.644
Beta (β) = 0.15	MSE	343327.759	354062.144	304579.0228	253638.732
	MAPE	36.640	41.50	24.584	25.272

Table 2 shows chairs without armrest accuracy measures

The highlighted cells represent the most accurate measures; using three weighted moving average will be best suited for chairs without armrest.

The current demand is shown in the following Table 3:

Component\Month	1	2	3	4	5	6	7	8	9	10	11
Shell	878	1000	1200	1262	2452	734	1830	668	848	1291	1242
Fixing rod left	878	1000	1200	1262	2452	734	1830	668	848	1291	1242
Fixing rod right	878	1000	1200	1262	2452	734	1830	668	848	1291	1242
Front glide left	1756	2000	2400	2524	4904	1468	1830	1336	1696	2506	2484
Front glide right	878	1000	1200	1262	2452	734	1830	668	848	1291	1242
Rear glide right	878	1000	1200	1262	2452	734	1830	668	848	1291	1242
Chairs without armrest steel frame	878	1000	1200	1262	2452	734	1830	668	848	1291	1242

Table 3 shows chairs without armrest current demand

The calculation of forecasted demand:

Forecasted demand for period four = ((Demand for period 1) + (2*Demand for period two) + (3*Demand for period 3))/6

Forecasted demand is shown in Table 4:

Component\Month	1	2	3	4	5	6	7	8	9	10	11
Shell	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Fixing rod left	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Fixing rod right	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Front glide left	1756	2000	2400	2159	2213	2226	2211	2216	2216	2215	2216
Front glide right	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Rear glide right	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Chairs without armrest steel frame	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 4 shows chairs without armrest forecasted demand.

3.2.2.1.2 Economic Order Quantity (EOQ)

The calculation of EOQ was made using excel sheet, the results are shown in table 5.

BILL OF MATERIAL

Code	Material Description	Qty / Unit	Annual Demand (D)	Unit Price (AED)	Setup Cost	Holding Cost	Q*
PNS/0001	Shell g5, 6	1	11914	68	137	7.311	668.203
PNA/0001	Fixing rod left 5, 6	1	11914	2	137	0.172	4360.635
PNA/0002	Fixing rod right 5, 6	1	11914	2	137	0.172	4360.635
PNA/0007	Front glide	2	23829	2	137	0.251	5099.373
PNA/0008	Rear glide left	1	11914	2	137	0.258	3560.443
PNA/0009	Rear glide right	1	11914	2	137	0.258	3560.443
SFG/	Chairs without armrest steel frame	1	11914	42	137	4.507	851.109

Table 5 shows chairs without armrest forecasted EOQ.

> Where:
> H: Holding Cost = Unit Price * 10.73%.
> Q*= ((2DS)/H)) ^0.5.

3.2.2.1.3 Material Requirement Planning (MRP)

MRP based on EOQ lot sizing was developed for each product besides that MRP using L4L was calculated and it's available in appendix (2). To apply the MRP (EOQ sizing):

First the BOM structure and MPS were built. The most accurate forecast was considered to obtain the net predicted demand. Then, the net requirements were translated into time phased requirements. After that, EOQ formula was used to determine the other ordering policy and obtain the planned order release. Next, the ending inventory for the component was calculated by the formula:

> Ending inventory = Beginning inventory + Planned delivers − Net requirements.
> Finally, the total inventory cost was calculated by:

TIC = no. of orders x ordering cost + Cumulative Ending Inventory * holding cost
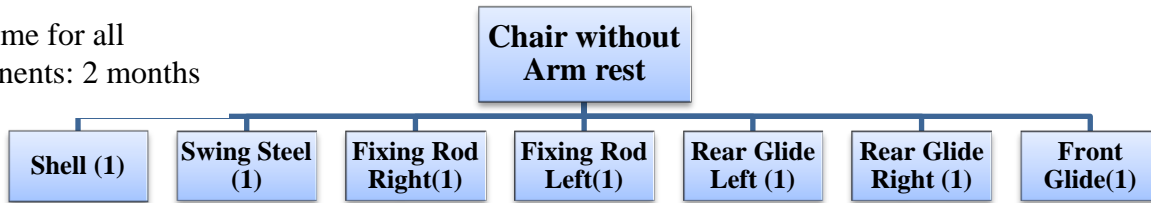
Lead time for all
components: 2 months

| Chair without Arm rest |
| Shell (1) | Swing Steel (1) | Fixing Rod Right(1) | Fixing Rod Left(1) | Rear Glide Left (1) | Rear Glide Right (1) | Front Glide(1) |

Figure 2: BOM of chairs without armrest

- Material Requirement Planning (EOQ) of Shell:

Table 6: MPS of Panto Shell

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 7: MRP calculations of Shell

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Time Phased Net Requirements	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108		
Planned Order Release (EOQ)	668	668	668	668	668	668	668	668	668	668	668		
Planned Deliveries			668	668	668	668	668	668	668	668	668	668	668
Ending Inventory			-210	-542	-1073	-1485	-1923	-2368	-2805	-3245	-3685	-4124	-4564

Cumulative Ending Inventory: -26022   Holding Cost: 0
Ordering Cost: 1507   Total Inventory Cost: 1507

- Material Requirement Planning (EOQ) of Fixing Rod Left:

Table 8: MPS of Fixing Rod Left

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 9: MRP calculations of Fixing Rod Left

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Time Phased Net Requirements	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108		
Planned Order Release (EOQ)	4361	0	0	0	4361	0	0	0	4361	0	0		
Planned Deliveries			4361	0	0	0	4361	0	0	0	4361	0	0
Ending Inventory			3483	2483	1283	203	3458	2345	1239	131	3384	2277	1169

Cumulative Ending Inventory: 21455   Holding Cost: 2302

Ordering Cost: 411   Total Inventory Cost: 2713

- Material Requirement Planning (EOQ) of Fixing Rod Right:

Table 10: MPS of Fixing Rod Left

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 11: MRP calculations of Fixing Rod Right

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Time Phased Net Requirements	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108		
Planned Order Release (EOQ)	4361	0	0	0	4361	0	0	0	4361	0	0		
Planned Deliveries			4361	0	0	0	4361	0	0	0	4361	0	0
Ending Inventory			3483	2483	1283	203	3458	2345	1239	131	3384	2277	1169

Cumulative Ending Inventory :   21455   Holding Cost: 2302

Ordering Cost: 411   Total Inventory Cost: 2713

- Material Requirement Planning (EOQ) of Front Glide:

-

Table 12: MPS of Front Glide

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	1756	2000	2400	2159	2213	2226	2211	2216	2216	2215	2216

Table 13 MRP calculations of Front Glide

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			1756	2000	2400	2159	2213	2226	2211	2216	2216	2215	2216

Time Phased Net Requirements	1756	2000	2400	2159	2213	2226	2211	2216	2216	2215	2216		
Planned Order Release (EOQ)	5099	0	0	5099	0	5099	0	5099	0	5099	0	0	
Planned Deliveries			5099	0	5099	0	5099	0	5099	0	5099	0	0
Ending Inventory			3343	1343	4042	1883	4769	2542	5431	3214	6097	3882	1666

Cumulative Ending Inventory: 38213 Holding Cost: 4100

Ordering Cost: 685 Total Inventory Cost: 4785

- Material Requirement Planning (EOQ) of Rear Glide Right:

Table 14: MPS of Rear Glide Right

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 15: MRP calculations of Rear Glide Right

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Time Phased Net Requirements	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108		
Planned Order Release (EOQ)	3560	0	0	3560	0	0	3560	0	0	3560	0		
Planned Deliveries			3560	0	0	3560	0	0	3560	0	0	3560	0
Ending Inventory			2682	1682	482	2962	1856	743	3197	2089	981	3434	2326

Cumulative Ending Inventory: 22434 Holding Cost: 2407

Ordering Cost: 548 Total Inventory Cost: 2955

- Material Requirement Planning (EOQ) of Rear Glide Left:

Table 16: MPS of Rear Glide Left

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 17: MRP calculations of Rear Glide Left

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Time Phased Net Requirements	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108		
Planned Order Release (EOQ)	3560	0	0	3560	0	0	3560	0	0	3560	0		
Planned Deliveries			3560	0	0	3560	0	0	3560	0	0	3560	0
Ending Inventory			2682	1682	482	2962	1856	743	3197	2089	981	3434	2326

Cumulative Ending Inventory: 22434   Holding Cost: 2407
Ordering Cost: 548   Total Inventory Cost: 2955

- Material Requirement Planning (EOQ) of Chairs without armrest Steel Frame:

Table 18: MPS of Chairs without armrest Steel Frame

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Demand	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108

Table 19: MRP calculations of Chairs without armrest Steel Frame

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
Net Requirements			878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108
Time Phased Net Requirements	878	1000	1200	1080	1107	1113	1105	1108	1108	1108	1108		
Planned Order Release (EOQ)	851	851	851	851	851	851	851	851	851	851	851		
Planned Deliveries			851	851	851	851	851	851	851	851	851	851	851
Ending Inventory			-27	-176	-525	-754	-1009	-1271	-1526	-1783	-2040	-2296	-2553

Cumulative Ending Inventory: -13960   Holding Cost: 0
Ordering Cost: 1507   Total Inventory Cost: 1507

Same methodology is applied to rest of the products attached in appendix.

3.3 Model Analysis

The comparison will make it clear for the decision maker to choose the best model that will guarantee the improvement in controlling the inventory system.

3.3.1 Chairs without Armrest

3.3.1.1 Economic Order Quantity

Economic Order Quantity(EOQ)

Component	1	2	3	4	5	6	7
Current EOQ	708.77	4625.3	4625.3	5413.4	3776.6	3776.6	902.78
Forecasted EOQ	668.20	4360.6	4360.6	5099.3	3560.4	3560.4	851.10

1: Shell G5, 6.
2: Fixing Rod Left 5, 6.
3: Fixing Rod Right 5, 6.
4: Front Glide.

5: Rear Glide Left.
6: Rear Glide Right.
7: Chair without arm rest Steel Frame
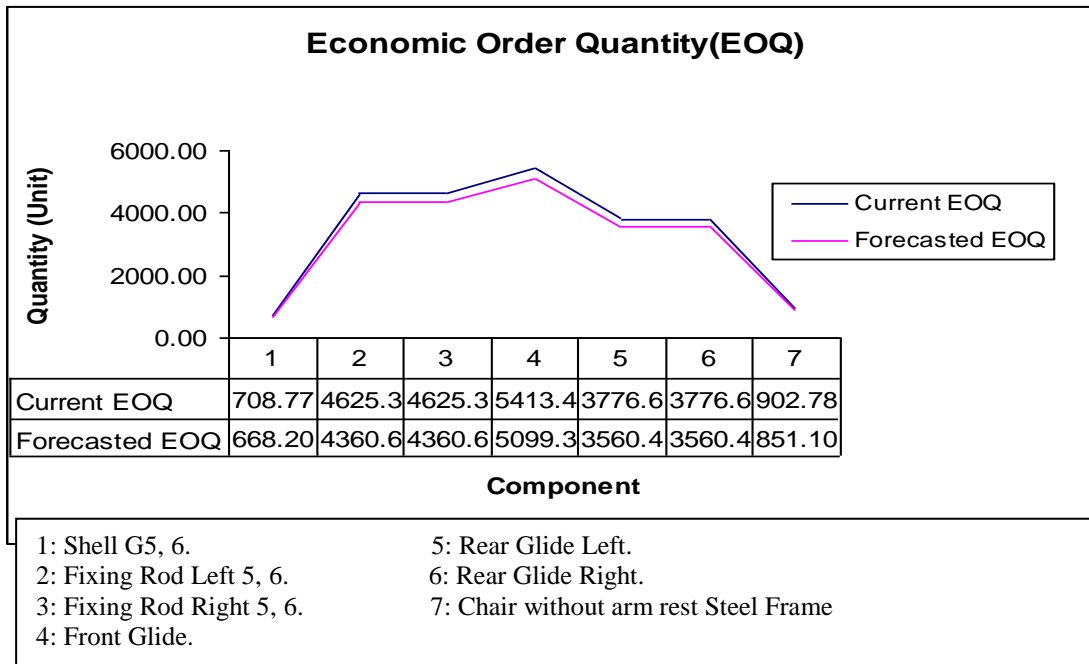
Figure 3: Economic Order Quantity of chairs without armrest

3.3.3.2 Inventory Cost
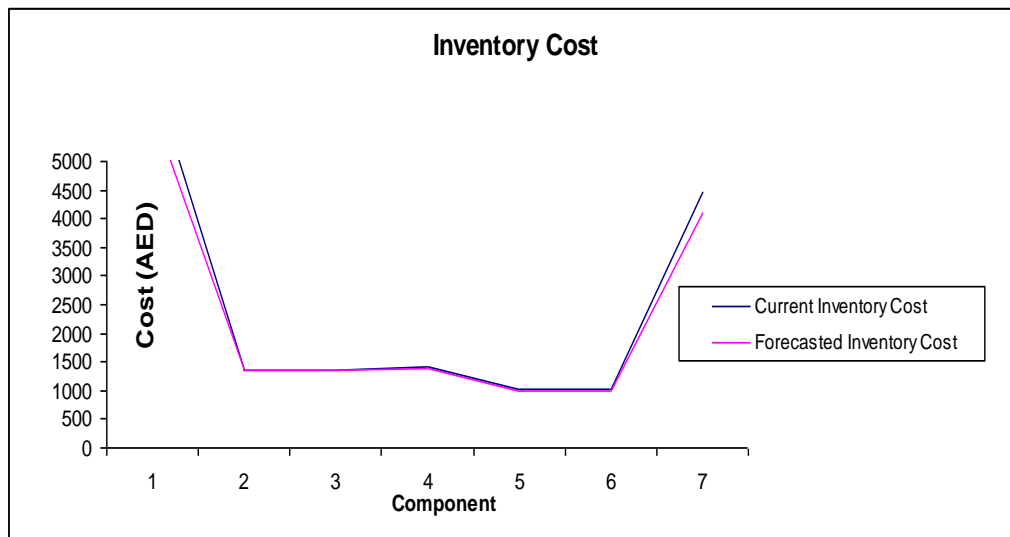
Figure 4: Chairs without armrest Inventory Cost

Current Cost = 17147 AED
Forecasted Cost = 16047 AED

3.3.3.2 MRP Inventory Cost
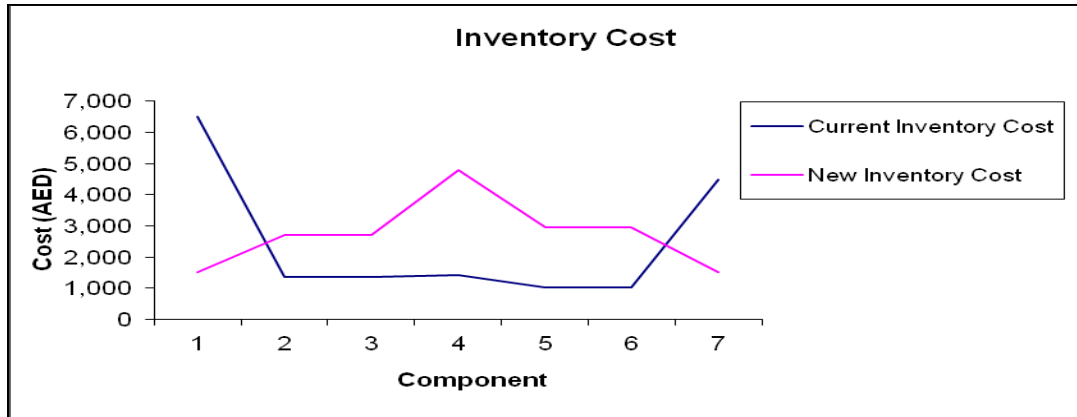
Figure 5: Chairs without armrest MRP Inventory Cost

Current Cost = 17147 AED
Forecasted Cost = 19136 AED

All other types of chair calculation and costs are attached in appendix 2.

4. RESULTS AND ANALYSIS

This section will summarizes the inventory cost for each product and the total inventory cost of all components beside the changes on turnover ratio of products after implementing the new inventory model.

4.1 Product inventory cost

4.1.1 Chairs without armrest
4.1.1.1 EOQ Inventory Cost
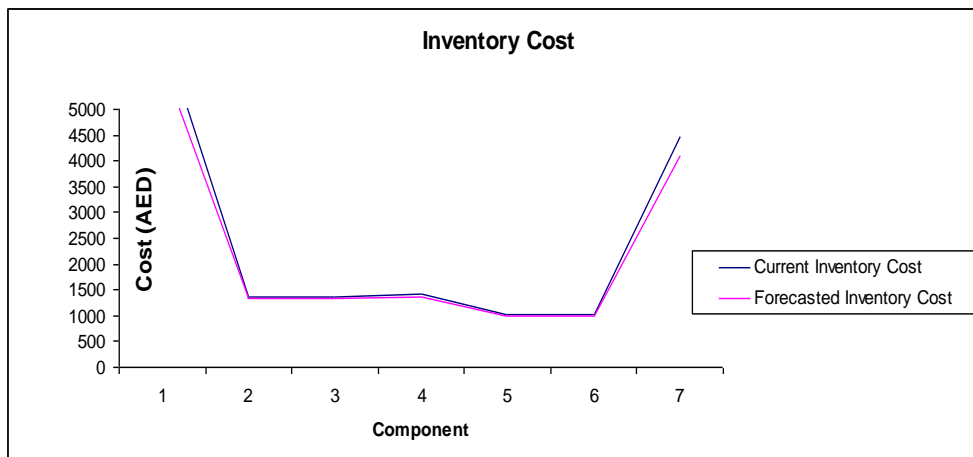
————— , Represent the Cost of Current Annual Demand=13405 unit
————— , Represent the Cost of Forecasted Annual Demand = 11914 unit

Figure 6: Chairs without armrest EOQ Inventory Cost

Current Cost = 17147 AED
Forecasted Cost = 16047 AED
Percentage Reduced = 6.4

4.1.1.2   MRP Inventory Cost
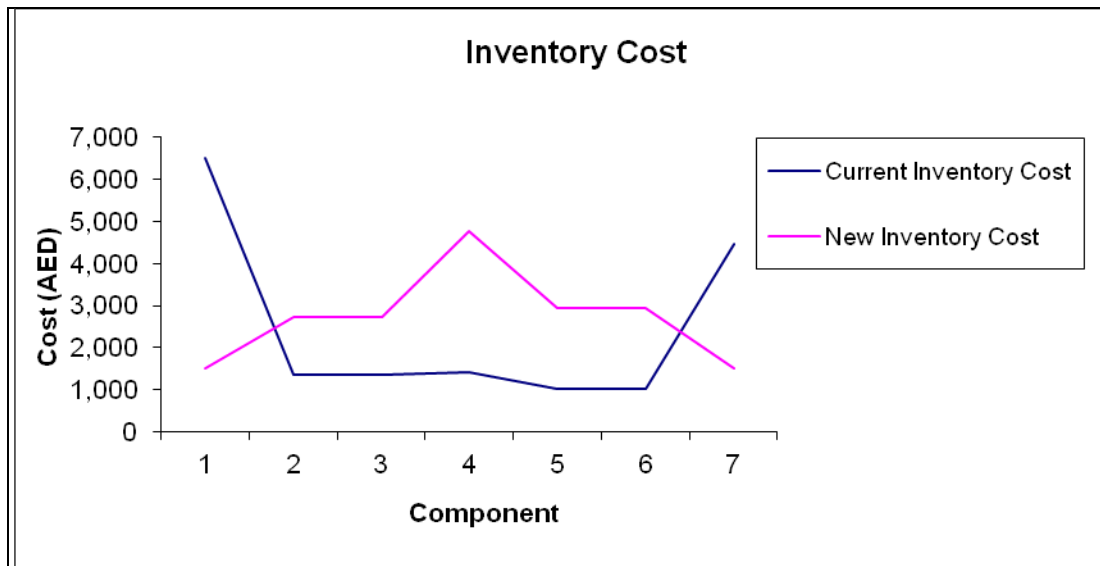
—— , Represent the Cost of Current Annual Demand=13405 unit
—— , Represent the Cost of Forecasted Annual Demand = 11914 unit

Figure 7: Chairs without armrest MRP Inventory Cost

Current Cost = 17147 AED
Forecasted Cost = 19136 AED

Percentage Increased = 11.6%

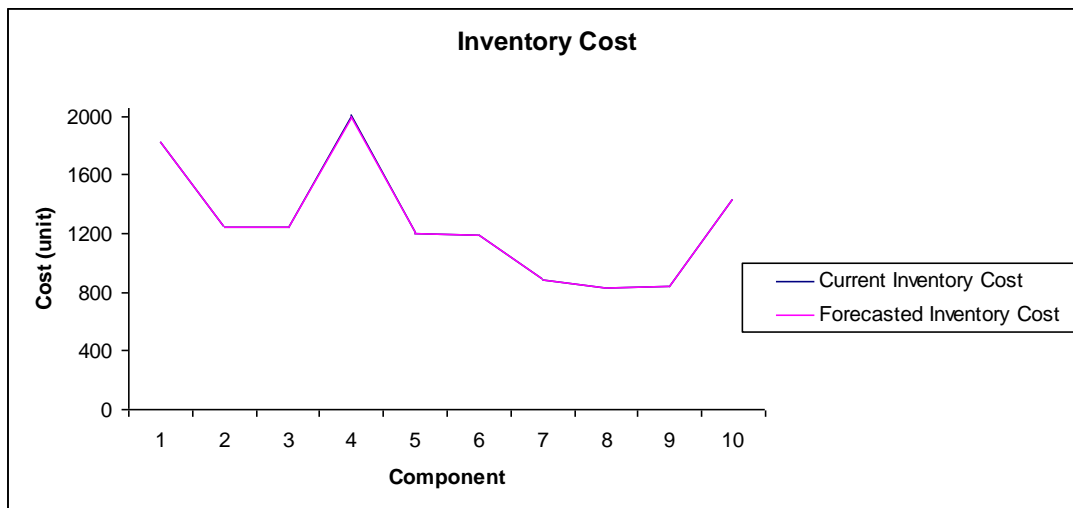**4.1.2   Class room chair**

4.1.2.1 EOQ Inventory Cost
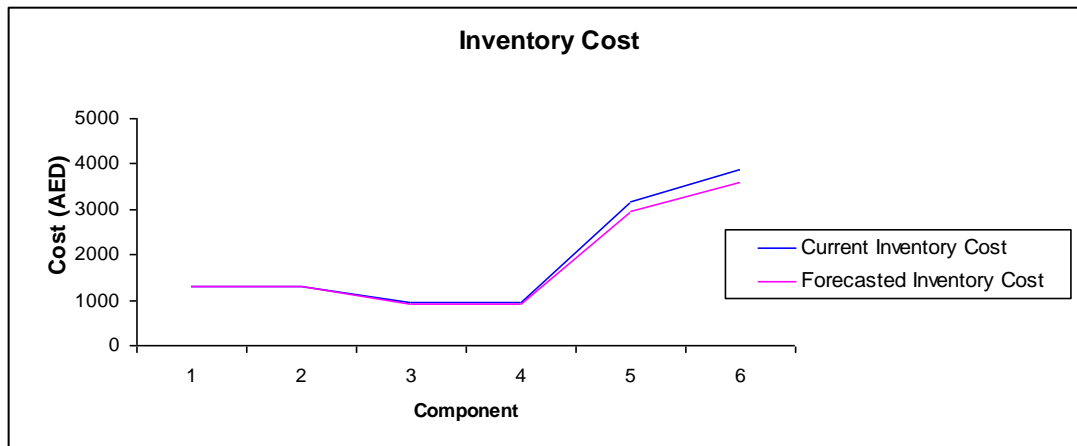
—— , Represent the Cost of Current Annual Demand = 6751 unit

—— , Represent the Cost of Forecasted Annual Demand = 6019 unit

Figure 8 Class room chair EOQ Inventory Cost

Current Cost = 11545 AED
Forecasted Cost = 10947 AED
Percentage Reduced = 5.2 %

4.1.2.2   MRP Inventory Cost
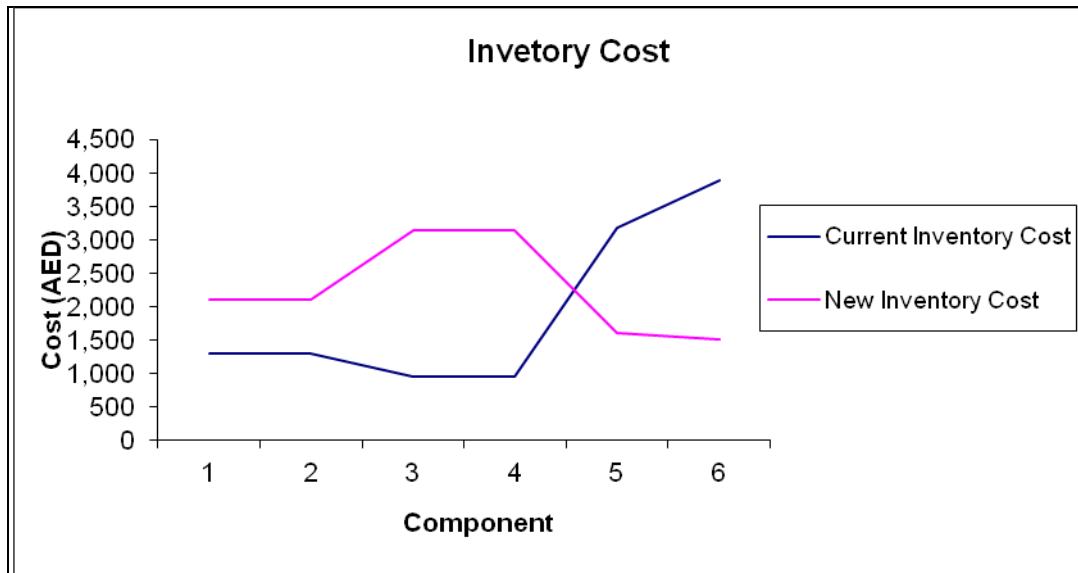
Figure 9 Class room chair MRP Inventory Cost

Current Cost = 11545 AED
Forecasted Cost = 13611 AED

Percentage Increased = 17.9%

4.1.3   Front Desk Chair
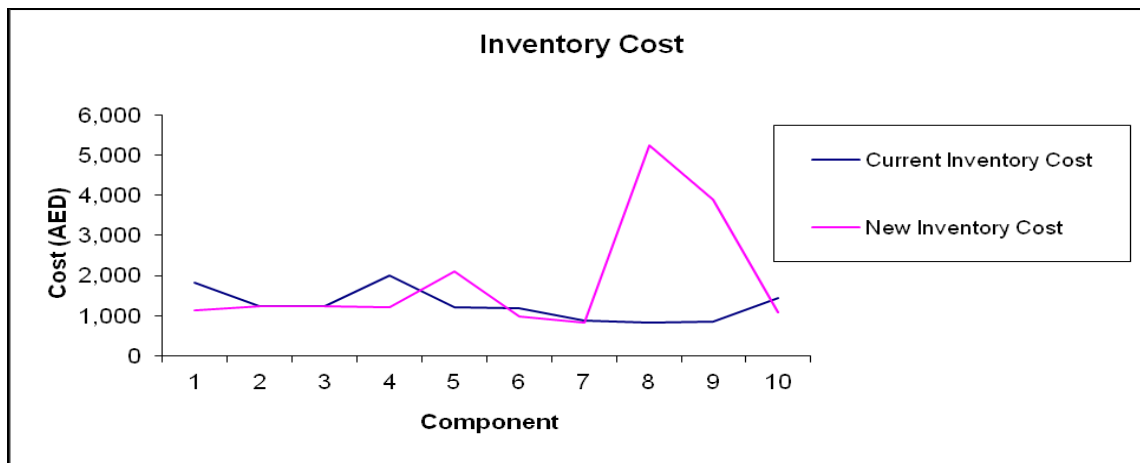
4.1.3.1   EOQ Inventory Cost
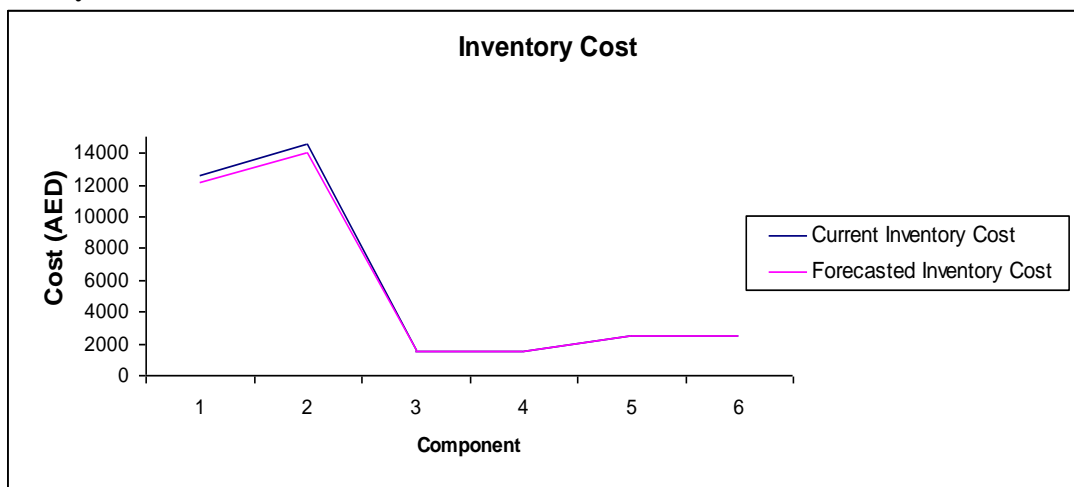
_____ , Represent the Cost of Current Annual Demand = 33898 unit

_____ , Represent the Cost of Forecasted Annual Demand = 32671 unit

Figure 10 Front Desk Chair EOQ Inventory Cost

Current Cost = 35305 AED
Forecasted Cost = 34236 AED
Percentage Reduced = 2.99%

4.1.3.2   MRP Inventory Cost
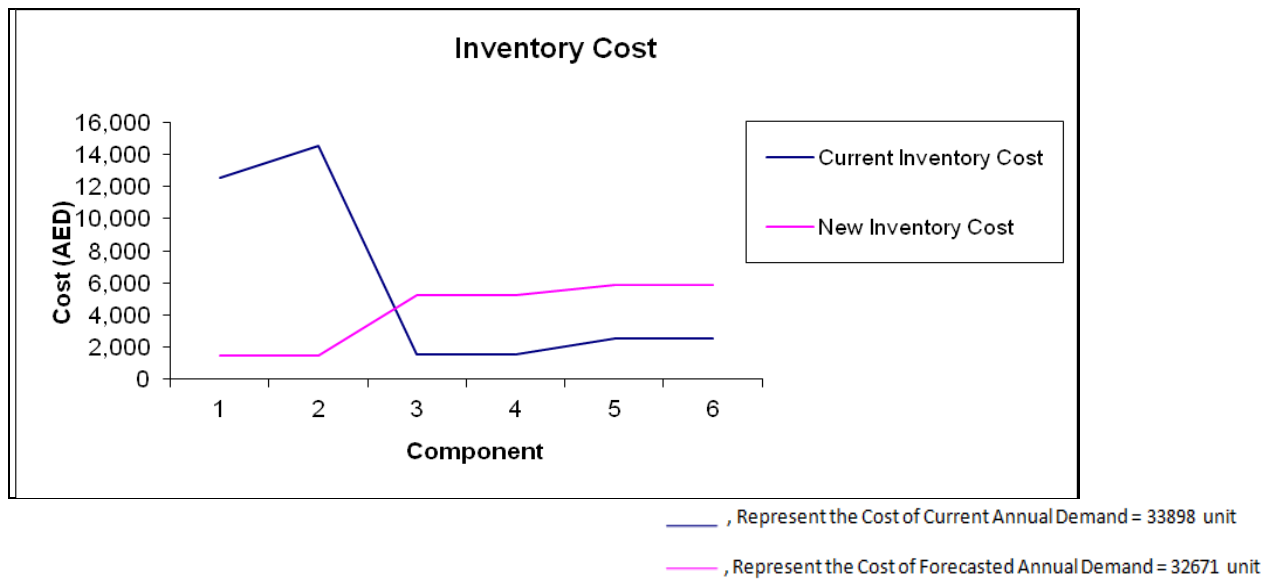
Figure 11: Front Desk Chair MRP Inventory Cost

Current Cost = 35305 AED
Forecasted Cost = 25280 AED
Percentage reduced = 28.4%

4.1.4   Waiting Area Chair

4.1.4.1 EOQ Inventory Cost
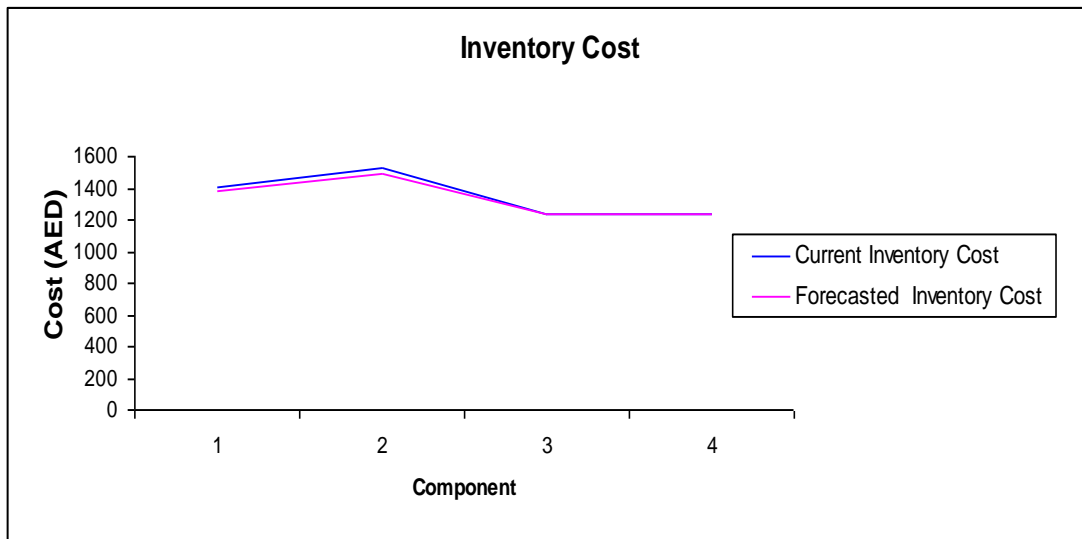
Figure 12: Front Desk Chair EOQ Inventory Cost

Current Cost = 5410 AED
Forecasted Cost = 5357 AED
Percentage Reduced = 0.98%

4.1.4.2 MRP Inventory Cost
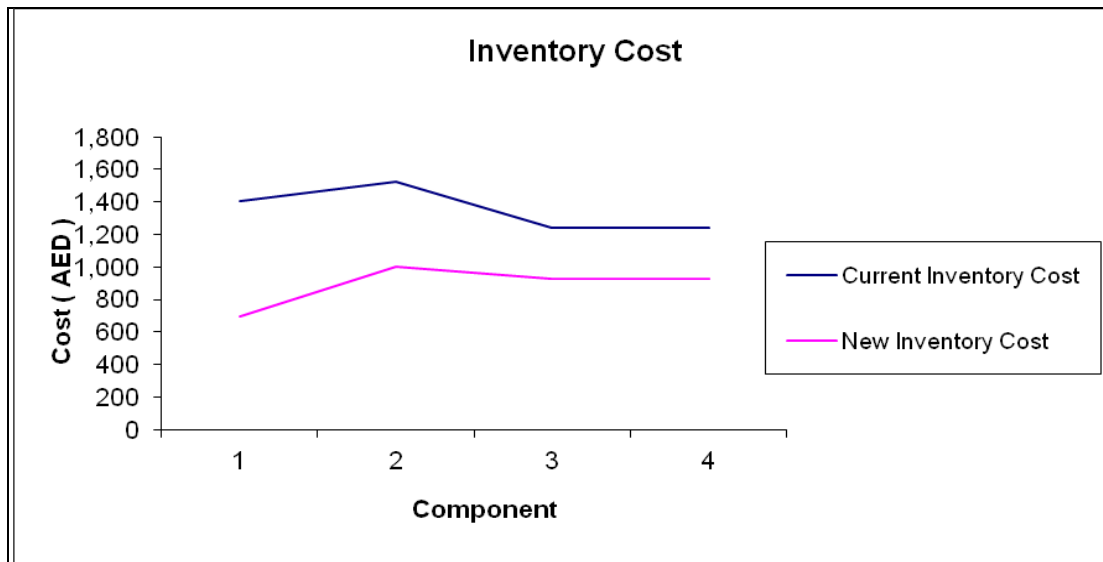
_____ , Represent the Cost of Current Annual Demand= 13405 unit
_____ , Represent the Cost of Forecasted Annual Demand = 11914 unit

Figure 13 Waiting Area Chair MRP Inventory Cost

Current Cost = 5410 AED
Forecasted Cost = 3549 AED
Percentage Reduced = 34.4%

4.1.5   Revolving Chair

4.1.5.1 EOQ Inventory Cost

_____ , Represent the Cost of Current Annual Demand = 1500 unit
_____ , Represent the Cost of Forecasted Annual Demand = 1499 unit

Figure 14 Revolving Chair EOQ Inventory Cost

Current Cost = 12692 AED
Forecasted Cost = 12689 AED
Percentage Reduced = 0.024%

4.5.1.2 MRP Inventory Cost

— , Represent the Cost of Current Annual Demand = 1500 unit
— , Represent the Cost of Forecasted Annual Demand = 1499 unit

Figure 15 Revolving Chair MRP Inventory Cost

Current Cost = 12692 AED
Forecasted Cost = 18946 AED
Percentage Increased = 49.3%

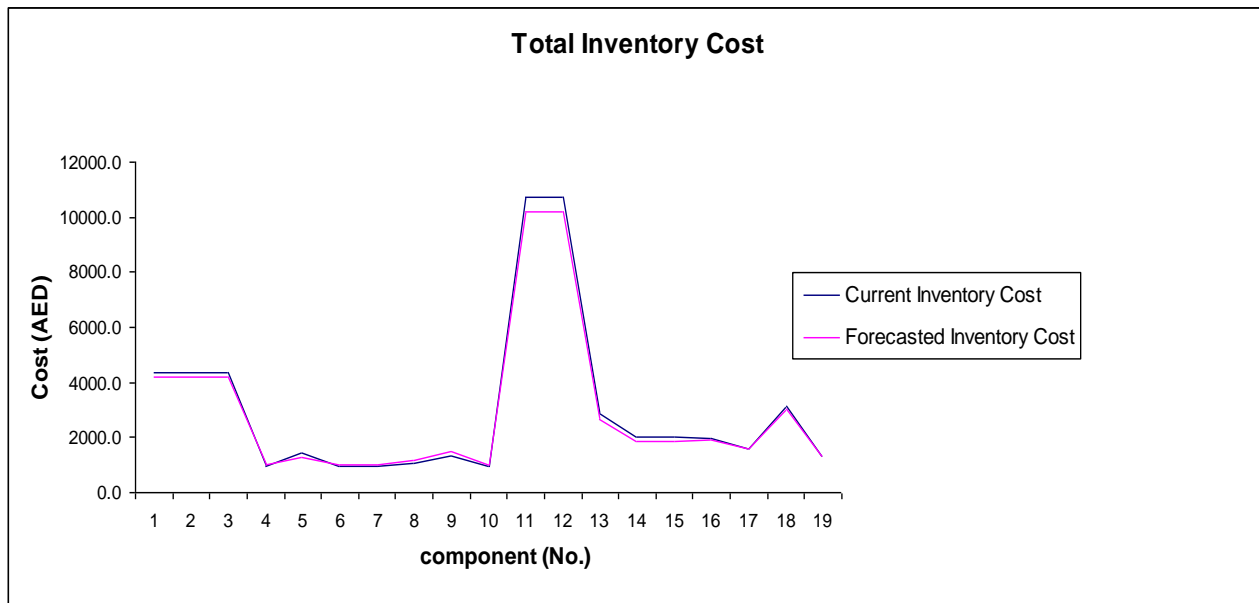## 4.2   Total inventory cost of all components (EOQ method)

Figure 16 Total Inventory Cost (EOQ method)

Current Cost = 57039.2 AED
Forecasted Cost = 55154 AED
Percentage Reduced = 3.3%

4.3 Inventory Turn-Over of Products

Turnover Ratio

Product	1	2	3	4	5
Current Turnover Ratio	3.5	4.2	15.4	1.5	1.4
Forecasted Turnover Ratio	5.7	7.8	23.9	4.3	3.0
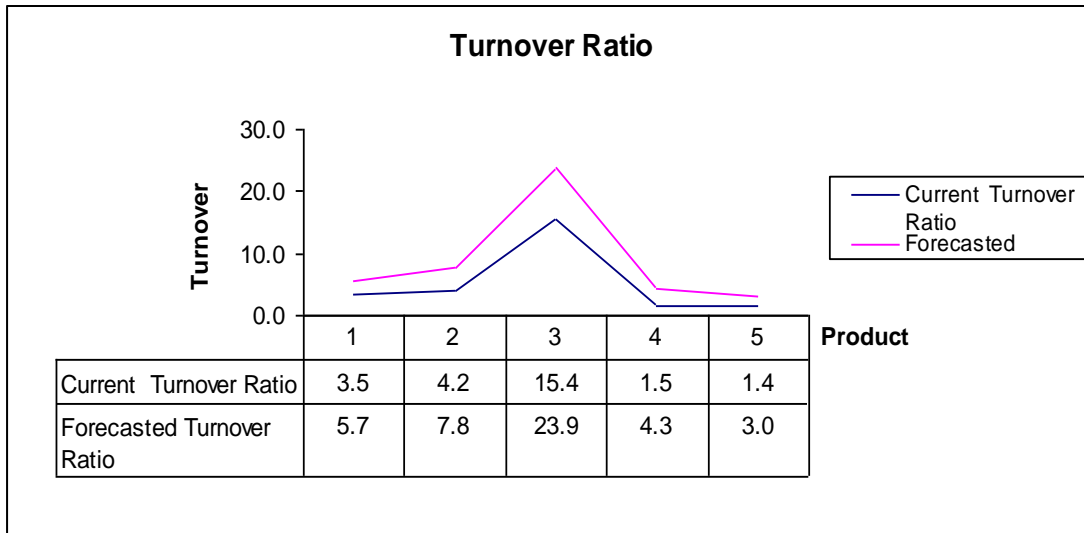
Figure 17 Inventory Turn-Over of Products

The turnover of each product was improved after reducing the quantity ordered by implementing the EOQ.
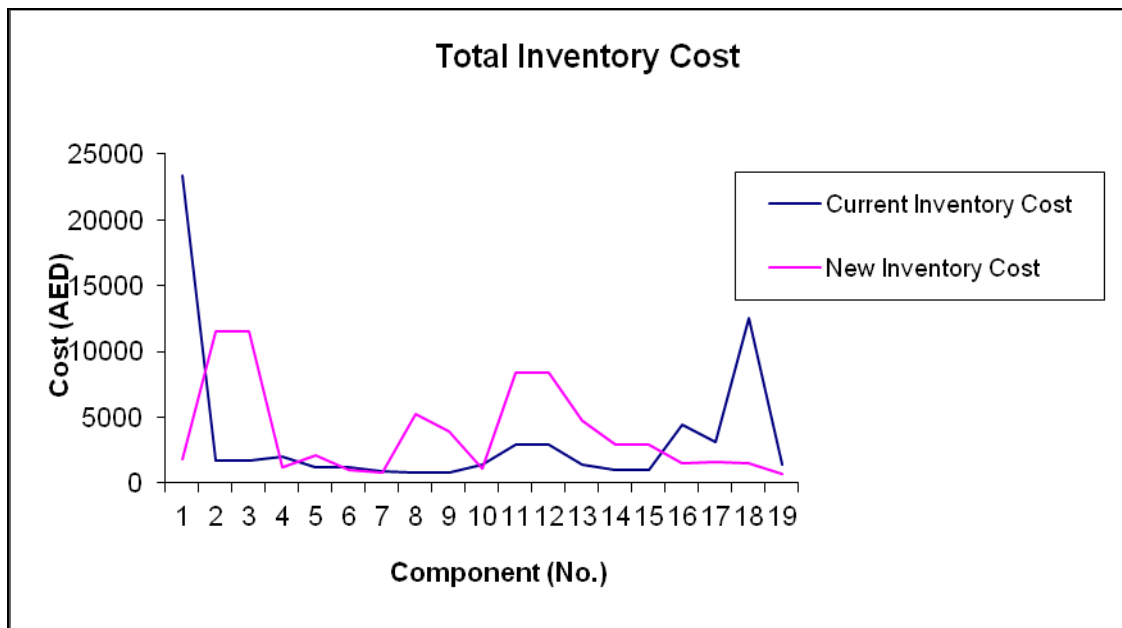
4.4 Total Inventory Cost (MRP method)

Figure 18 Total Inventory Cost (MRP method)

Current Cost = 57039.2 AED
Forecasted Cost = 71224 AED
Percentage Increased = 24.9%

5. CONCLUSION

In this paper we tried to establish a cost effective inventory management system for a furniture manufacturing company after considering a real case study. The proposed forecasting method can produce optimum solutions for inventory in terms of reduced ordering cost and holding cost. The calculated EOQ and MRP for different components identified effective cost saving for forecasting process.

For further studies, adequate optimization techniques can be useful with probabilistic forecasting methods.

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