

# **A Study on Inventory Management of Faith & Love Furniture Manufacturing Firm**

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## **Abstract**

Predicting exact levels of sales and raw materials usage needs for production were the most pertinent reasons why organizations maintain inventory management. As such, inventory serves as a buffer against uncertain and fluctuating demands while ensuring the availability of a supply of items in case a need arises for them by customers. Thus, following this understanding, the aim of this paper is to explore and analyze the inventory control of Faith & Love Furniture (F&L), a small business firm. This paper hence consists of two parts. The first investigates the current inventory control practices of F&L. The second part analyzes inventory control procedures such as product classification, when to order (reorder point), how much to order (order quantity and safety stock), and the total inventory cost calculation. The analysis of suitable mathematical models for the firm is the basis for these aforementioned procedures. Then, after thorough research and analysis, the most suitable mathematical model is deducted so that a comparison can be drawn between the costs of using it and F&L's current inventory order practice. The juxtaposition will produce the most optimal cost savings and reach the main objective of 'minimizing the cost'. The effectiveness of inventory analysis can be seen after such meticulous deductions in the end.

Key Words: Inventory, Reorder Point, Order Quantity, Safety Stock

## **Introduction**

Inventory management is paramount to a manufacturing firm, with inventory typically comprising of ten to forty-five percent of the total assets. The American Production and Inventory Control Society (APICS) defined inventory management as the branch of business management concerned with the planning and controlling of inventories (Toomey, 2000). The vital reason that organizations maintain inventory is due to the rare possibility of predicting sales levels and raw materials usage needs for production exactly.

While inventory serves an important and essential role, the expense associated with financing and maintaining inventories is a substantial part of the cost of doing business. Effective inventory management is essential to the operation of any business with an aim to reduce cost items such as capital cost for inventory and handling cost of flows.

As a manufacturing firm, Faith & Love Furniture Firm should consider minimizing cost for inventory and maximizing expected profits based on a given distribution of the item under varying types of demand. Hence, paper will focus on this point and to analyze the firm's inventory cost.

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## **Objectives of the Study**

The objectives of this paper are

1. To explore the inventory management of Faith & Love Furniture Manufacturing Firm
2. To analyze the inventory management in Faith & Love Furniture Manufacturing Firm

## **Scope and Method of the Study**

This study only focuses on inventory management of Faith & Love Furniture Manufacturing Firm while applying descriptive method. Primary data is collected from in-depth personal interview with owner, factory manager and other related staffs from factory. The secondary data is collected from firm's sales and expenditure from purchasing records, demanding records and other related documents. The study period is 2013

In analysis part, twenty items of raw materials are selected to conduct the ABC analysis, reorder point identification and reorder quantity determination. To achieve pertinent information, selecting twenty samples in which every unit in the inventory has a chance of being selected, but probability of choosing as sample can be accurately determined based on its price and demand. From ABC analysis, one item from twenty items is explored. This item is utilizing largest amount of inventory cost and the inventory cost analysis is conducted only for this item.

## **Analysis of the Firm**

After several interviews with the owner, manager and staff in F&L Furniture, there was not a formalized inventory control system. Normally, the owner or manager placed new orders from his intuition and experience, or when inventory happened to be found few left in the information system or as the result of visual check by the storekeeper working in the warehouse. Such practice has two opposite results. The first one is stock-out, where the customers have to wait for a period of time, shorter or longer, if they do not cancel the order. The second one is overstock, where unnecessary inventory accumulates and sits in the warehouse, costly but useless.

Therefore, analysis mentions the following four formalized and standardized inventory control procedure to implement for solving the problems.

- Step (1)           ABC Analysis
- Step (2)           Reorder Point (ROP) Identification
- Step (3)           Order Quantity Determination
- Step (4)           Inventory Cost Calculation

### **Step (1)        ABC Analysis in the Firm**

At present, there have been a lot of different raw materials and furniture products in F&L's warehouse. If the manager and staffs allocate same time and effort on inventory control for each item, it would take them extra time and effort that would have been used otherwise, hence increasing labor costs. Based on the content in the theoretical framework, all the inventory items are classified into several different level groups, and then the different inventory groups can be treated differently. This

classification can save much time, effort and cost on the daily inventory operation. And it is a cost-efficient solution for the company, with improved management under limited resources.

Following the procedures of ABC analysis presents each item's annual quantity usage and total annual kyats usage. According to the list of sample twenty items in rank ordered by percentage of kyats usage and classify them into A, B or C. F&L's decision maker have an ambition to use 50% of total inventory value for Category A items, 80% for Category B items and 20% for the Category C items. In accordance with this real situation of the sampled twenty items in F&L Furniture, 10-25-65 was established as the appropriate percentage of the items for the classification as shown in Table 1.

ABC analysis is a kind of technique, which provides the means for identifying those items that make the largest impact on a company's overall inventory cost performance. From Table, Category A items should be controlled more closely on inventory records, and they need more frequent reviews in terms of forecasting, demand inquiry and order quantity determination. The next Category B items should have less control compared to A items and be review less frequently. The last Category C items should have the least control and be reviewed over a long time, safety stock is not made at all.

**Table 1 Ranking of Items by ABC Classification**

Sr. No.	Item	Code No.	Annual Demand	Unit Cost (Kyats)	Total Annual Usage of Kyats Value	Percentage of Kyats Value	Cumulative Percent		Classification
							Kyats Value	Items	
1	2	15/2-203S	517.75	44,000	22,781,000	25.84%	25.84%	5%	A
2	7	25/2-203S	353.5	63,800	22,553,300	25.58%	51.43%	10%	A
3	4	16/2-203S	187.25	47,300	8,856,925	10.05%	61.47%	15%	B
4	5	18/2-230S	114	49,500	5,643,000	6.40%	67.87%	20%	B
5	3	15/2-310S	105.75	45,100	4,769,325	5.41%	73.28%	25%	B
6	18	2"Wheel	2,337	1,650	3,856,050	4.37%	77.66%	30%	B
7	16	JCBC	29,970	120	3,596,400	4.08%	81.74%	35%	B
8	6	25/2-329S	31.75	67,100	2,130,425	2.42%	84.15%	40%	C
9	8	E22/DG	10,487	200	2,097,400	2.38%	86.53%	45%	C
10	13	30A/4SQ	132	14,100	1,861,200	2.11%	88.64%	50%	C
11	12	30A/DFB	94	15,000	1,410,000	1.60%	90.24%	55%	C
12	11	30A/Column	122	11,200	1,366,400	1.55%	91.79%	60%	C
13	10	E19/DG	8,133	150	1,219,950	1.38%	93.18%	65%	C
14	9	E19/BL	7,353	150	1,102,950	1.25%	94.43%	70%	C
15	14	LB/Metal A	10,550	100	1,055,000	1.20%	95.63%	75%	C
16	17	Minifix	5125	200	1,025,000	1.16%	96.79%	80%	C
17	15	Glu-Seed	8.25	110,000	907,500	1.03%	97.82%	85%	C
18	20	162 Profile	2,146	400	858,400	0.97%	98.79%	90%	C
19	1	3/Formica White	70.25	8700	611,175	0.69%	99.49%	95%	C
20	19	Screw 6 × 5/8	90,730	5	453,650	0.51%	100.00%	100%	C
<b>Total</b>			<b>168,567.50</b>		<b>88,155,050</b>	<b>100.00%</b>			

Source: Survey Data (F&L Furniture, 2013)

## **Step (2) Reorder Point Identification in the Firm**

According to F&L Furniture's data, two distinctive phenomena of the business practice are found out.

### **Analysis of Demand**

After analyzing the twenty's items monthly demand situation, the two phenomena have been found out. The first one is the seasonal fluctuation of demand occurs for the majority of these twenty items in June and July period, the rainy seasons in Myanmar. During these period, the demand was reduced that may be due to the difficulty of renovation and extension of homes and offices as well as transportation of the products. Therefore, these are the slack seasons for the company generally.

The second one is that the lead time regarding the main supplier in Malaysia. The lead time will at least take about 2 months when F&L makes the order, especially item A, directly from Malaysia. Therefore little can be done to shorten the total lead time.

### **Inventory Model**

Within current paper, taking into account some specific of empirical experience of ordering at the company, following are inventory management strategies selected for case study.

#### **(A) Continuous Review Model for Deterministic Demand**

According to formula, ROP is the average demand during the lead time plus a small amount of safety stock. So the average demand and decide the safety stock level is needed. If demand has little variability and the supplier's lead time is reliable, safety stock is easy to determine, hence ROP is easy to calculate and the result will be credible.

At present F&L Furniture has realized that there are problems in inventory management, which are not only a lack of formalized and standardized inventory system but also the fluctuation of demand, and the problems are growing faster and bigger. As response, the ROP systems are started to build for approximately 200 items, aiming at achieving efficient inventory management.

#### **(B) Periodic Review Model for Probabilistic Demand**

The periodic review, just as its name implies, means the inventory should be reviewed in a regular interval. Usually, the review period can be set arbitrarily. This model requires that order to supplement inventory to a level  $S$  is one once in a definite period of time and suitable for fluctuating demand. The period between orders can be either calculated or acquired in empirical way.

According to the data from this current case study, F&L's placed three orders per year for the Category A items. On the other hand, the lead time for most items of the Category A, B and C is three months because of the average lead time for products

from the supplier out of Myanmar especially from Malaysia is around two months. The buffer one month is due to the postponement of actual purchase order in order to use full-container-load (FCL) and save transportation costs.

Based on these two conditions, the review period for the Category A items is once per quarter, which is the same as the lead time three months; once every four months for B items and once per half year for C items. Then the review frequency over one year is four times, three times and two times for A, B, C items respectively. Therefore, the reorder time of F&L Furniture is suggested to set as a fixed review period for each category group showing as follow:

For A items New order should be released three months later than the last order.

For B items New order should be placed four months later than the last order.

For C items New order should be released six month later than the last order.

Moreover, F&L Furniture is suggested to use the cycle counting to increase the accuracy of the inventory information. F&L should set up a process of determining which parts numbers to count and how frequently to count them; Classifying its inventory as A, B or C. Setting a count tolerance for each level of inventory (ABC) and assigning personnel to conduct the counts and correct the inventory data. A better process is to focus on identification of the causes of the errors and taking corrective action to eliminate these causes. In this paper, the cycle counting is not described for F&L Furniture because it is only mentioned for 20 items.

### **Step (3) Order Quantity Determination in the Firm**

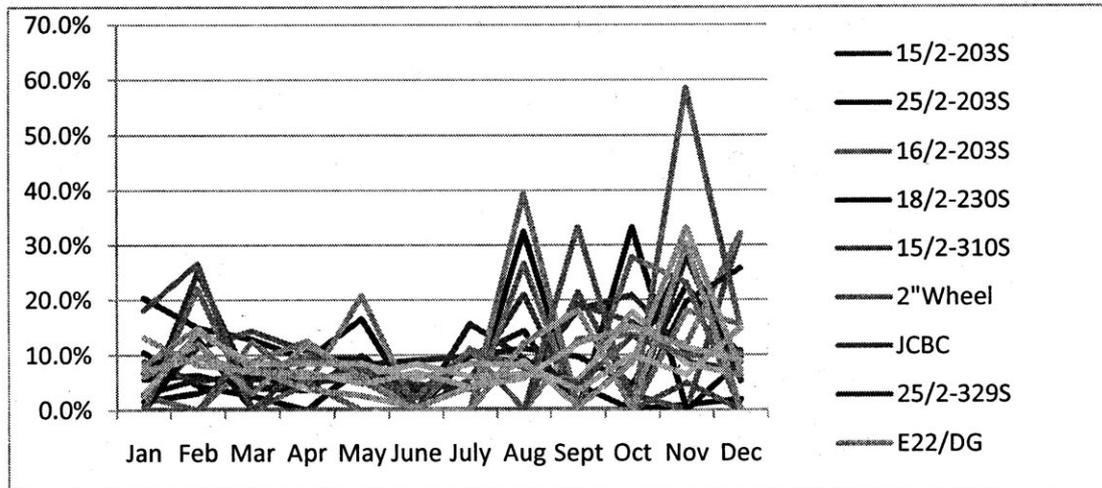
Periodic review is more appropriate for F&L Furniture to solve “when to order?” Following the logic of periodic review policy, the data is continued to analyze and identify the most suitable order quantity model for replenishment.

#### **Analysis of Demand**

After analyzing the data in Figure 1, two conditions are concluded. Firstly, one type of the Category A item was decreasing (Code No. 15/2-203S) while the other Category A item was increasing (Code No.25/2-203S) and vice versa, and noted as they were the substitute product to each other and stock-out of certain items is tolerant by certain customers.

According to the following Figure 1, second and generally is that the demand of second half of the year is more than that of first 6 months. The replenishment procedure of F&L Furniture has been traditionally treated from a multi-echelon and multi-product perspective. This existing company’s policy cannot obtain an optimal plan for a company with more than one item and echelon in a supply chain. Moreover, knowing that the optimization of inventory cost for a multi products case is very complex, F&L Furniture should adopt a mathematical modeling for calculation of logistic costs.

**Figure 1 Analysis of Annual Demand for Twenty Inventories**



Source Survey Data (Faith & Love Furniture, 2013)

### Inventory Model

Inventory control models are mathematical models that handle inventory problems such as inadequate inventory, excess inventory and costs associated inventory. A business or an industry usually maintains a reasonable inventory of goods to ensure smooth operation. Too little of it causes costly interruption and too much of it results idle capital. The models are used to determine the inventory level that balances the two extreme costs for specific company.

#### (A) Deterministic Models (Economic Order Quantity Model)

According to the theoretical framework, EOQ model is the best known and most fundamental inventory model, which is applicable when the demand for an item has constant, or nearly constant, rate and when the entire quantity ordered arrives in inventory at on-point in time. It also assumes no shortage in this inventory model. In this context, the economic order quantity model does not represent the best solutions for F&L Furniture because of deviation from the above rules. Moreover, in practice, a large number of inventory situations cannot be described by the deterministic models.

#### (B) Probabilistic Models (Periodic Review with Probabilistic Demand Model)

This F&L Furniture’s case study, the demand is no longer constant and deterministic, but probabilistic instead. Based on theory, “the periodic review model with probabilistic demand” approach is decided to choose. It is a statistical model applicable when product demand or any other variable is not known but can be specified by means of a probability distribution. Order quantity is allowed to be different for single replenishment, and should be adjusted according to the historical demand volume of the same period of recent years. Of course, last year’s data is more reliable than earlier years.

According to theory, the order quantity can be calculated from the equation

$$Q = M - H$$

But the demand  $Q$  is probabilistic, the inventory on hand at the review period,  $H$ , will vary. Thus the decision variable in the periodic review model is the replenishment level  $M$ , and general expression as

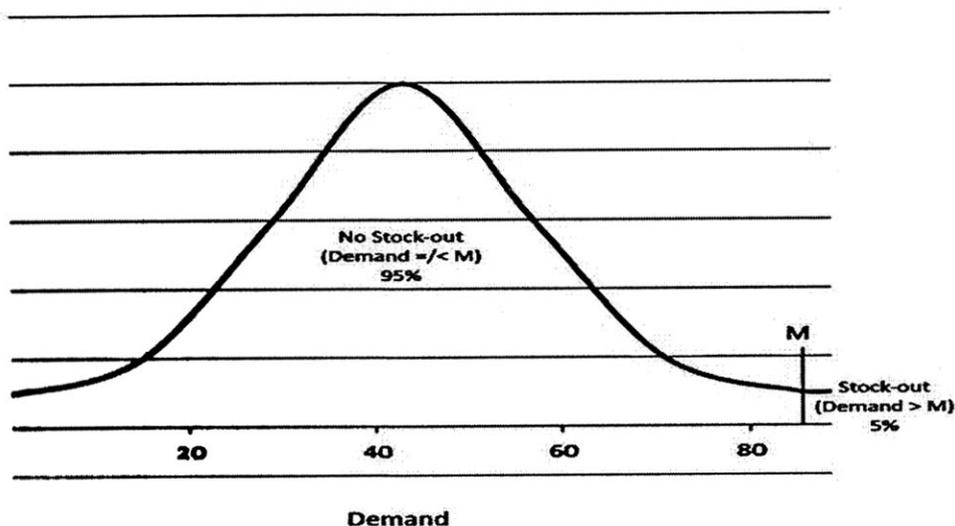
$$M = \mu + \zeta\sigma.$$

By using this equation, the mean demand during the review period plus the lead time period ( $\mu$ ) and the standard deviation of demand ( $\sigma$ ) can be calculated by using F&L's previous data. It is more reliable by using the recent previous data. But for the probability of stock-out ( $\zeta$ ), the management decisions of approaching performance level and company's objectives are the main themes.

Let consider F&L furniture, a firm with several items that carry a wide variety and fluctuated demand of raw materials and products, operates its inventory system with 3 months, 4 months and 6 months periodic review. In this approach, when making the order quantity decision for each product at a given review period, the top manager should know that their objective is to determine the replenishment level with a certain % chance of stock-out. In F&L's case, the management's objective is to determine the replenishment level with 5% acceptable chance of stock-out is assumed.

Figure 2 shows an example for the replenishment level ( $M$ ) of one of the Category A item (Code 15/2-203S) that allows a 5% chance of a stock-out associated with the replenishment decision. Using Table 2 and the normal probability distribution table, a value of  $M$  that is 1.96 standard deviations above the mean will allow the stock-out with 5% probability.

**Figure 2 Replenishment Level ( $M$ ) that allows a 5% Chance of a Stock-out**



Source: Survey Data (Faith & Love Furniture, 2013)

Let continue to consider about Code No. 15/2-203S, the mean demand during the review period and lead time period is 43 units, the standard deviation of mean demand is 28 units, the replenishment level is 97 units and there is a chance of stock-out with 5% probability. Using the equation  $Q = M - H$ , in which assumes the

inventory on hand (H) at 3 months intervals (Category A item) is 40 units, an order quantity should be made is 57 units. The calculation is as follow.

$$Q = M - H = 97 - 40 = 57 \text{ units}$$

Thus, under the periodic-review model, enough units are ordered each review period to bring the inventory position back up to the replenishment level.

On the other hand, F&L furniture reorder point was based on a 5% probability of a stock-out during the review period plus the lead time. Thus, on 95% of all order cycles, F&L will be able to satisfy customer demand without experiencing a stock-out. The higher inventory levels are necessary to allow for uncertain demand and to control the probability of a stock-out. In F&L case,  $97 - 43 = 54$  units is the safety stock that is necessary to absorb any higher-than-usual demand during the review period plus the demand during the lead time period. This safety stock limits the probability of a stock-out to 5%. An important concern of management is maintaining an adequate service level in the face of uncertain demand and stock-out. Therefore, one of the reasons for setting safety-stock is it could affect customer service level.

**Table 2 Replenishment Level of 20 items that Allows a 5% Chance of a Stock-out**

Sr. No.	Code No.	Mean Demand ( $\mu$ )	Allow Stock-out with 5% probability ( $\zeta$ )	Standard Deviation ( $\sigma$ )	The replenishment Level ( $M = \mu + \zeta\sigma$ )
1	15/2-203S	43.15	1.96	27.65	97
2	25/2-203S	29.46	1.96	24.59	78
3	16/2-203S	15.60	1.96	19.1	53
4	18/2-230S	9.50	1.96	13.78	37
5	15/2-310S	8.81	1.96	10.81	30
6	2"Wheel	194.75	1.96	109.18	409
7	JCBC	2497.50	1.96	1726.43	5881
8	25/2-329S	2.65	1.96	2.47	7
9	E22/DG	873.92	1.96	982.55	2800
10	30A/4SQ	11.00	1.96	11.54	34
11	30A/DFB	7.83	1.96	16.81	41
12	30A/Column	10.17	1.96	15.59	41
13	E19/DG	677.75	1.96	852.88	2349
14	E19/BL	612.75	1.96	854.19	2287
15	LB/Metal A	879.17	1.96	382.95	1630
16	Minifix	427.08	1.96	151.79	725
17	Glu-Seed	0.69	1.96	0.28	1
18	162 Profile	178.92	1.96	189.42	550
19	3/Formica White	5.85	1.96	2.55	11
20	Screw 6 x 5/8	7560.83	1.96	2941.69	13327

Source Survey Data (Faith & Love Furniture, 2013)

#### Step (4) Inventory Cost for the Firm

Because costs of inventories are very closely related to size of inventories, the top manager should keep his inventory as small as possible consistent with a market demand. This paper, hence, considers the effect of multi-products inventory costs with probabilistic demand.

For calculation of these costs, inventory costs are real but they are also difficult to determine because they cannot be taken directly from accounting records. The Category A items of the chip board materials (Code No. 15/2-203S) of imported products is only considered as an example in this case. Total cost calculation is based on 210,000 kyats per order and 5,200 kyats per holding cost per unit of item which are calculated in detail and not described in this paper.

##### (A) Annual Inventory Cost with Existing Policy

This current case study, F&L Furniture uses to order randomly and quantity of order is determined by their experience of inventory management of F&L. Their annual purchasing order quantity of Code No. 15/2-203S was 668 units and 3 orders was done within a year. Table 3 indicates its total annual inventory cost was 4,103,600 kyats.

**Table 3 Total Annual Cost by Existing Policy**

Sr. No.	Description	Ordering Times /Units	Per Cost (Kyats)	Amount (Kyats)
1	Annual Ordering Cost	3	210,000	630,000
2	Annual Holding cost	668	5,200	3,473,600
<b>Total Annual Inventory Cost</b>				<b>4,103,600</b>

Source: Survey Data (Faith & Love Furniture, 2013)

##### (B) Annual Inventory Cost with Periodic Review with Probabilistic Demand Model

As in theory, there is a model that can be used to determine how much should be ordered. It describes to determine the replenishment level (M), the company could begin by developing a total cost model, including holding, ordering, and stock-out costs.

In this case, the Category A item Code No. 15/2-203S has 3 months periodic review intervals, and assumes to review the stock and make an order at January, April, July and October.

**Table 4 Mean and Standard Deviation**

Quarter	Demand	Demand-Mean	(Demand-Mean) <sup>2</sup>
Q-1 (Jan to Mar)	82.75	-46.6875	2179.722656
Q-2 (Apr to June)	86	-43.4375	1886.816406
Q-3 (July to Sept)	158.5	29.0625	844.6289063
Q-4 (Oct to Dec)	190.5	61.0625	3728.628906
<b>Mean (<math>\mu</math>)</b>	<b>129.4375</b>		
Total			8639.796875
Variance ( $\sigma^2$ )			2879.932292
<b>SD (<math>\sigma</math>)</b>			<b>53.66</b>

**Table 5 Replenishment level that allows a 5% chance of a stock-out**

Code No.	Mean Demand ( $\mu$ )	Allow Stock-out with 5% probability( $\zeta$ )	Standard Deviation ( $\sigma$ )	The replenishment Level ( $M=\mu+\zeta\sigma$ )
15/2-203S	129.44	1.96	53.66	<b>235</b>

Source: Survey Data (Faith & Love Furniture, 2013)

It is obvious from Table 4 and Table 5, the mean demand during the 3 months review period and lead time period is 129 units, the standard deviation of mean demand is 54 units, the replenishment level is 235 units and there is a chance of stock-out with 5% probability for Code No. 15/2-203S. Using inventory in-hand level of 41, 152, 149 and 77 units respectively in four quarters according to Appendix 5 and calculating the equation  $Q = M - H$  in Table 6 gives the order quantity of 194, 83, 86 and 159 units respectively to order at the period of January, April, July and October.

Holding cost and ordering cost for each quarter is calculated by using data in Table 6 and finally total annual inventory cost of 3,550,500 kyats can be summarized for such item.

**Table 6 Total Inventory Cost of Quarterly Periodic Review Period**

Quarter	Replenishment Level (M)	Inventory in Hand (H)	Order Quantity (Q)	Holding Cost Per Unit	Holding Cost for Each Quarter	Ordering Cost for each Quarter	Total Cost for Each Quarter
Q-1 (January)	235	41	194	5,200	1,008,800	210,000	1,218,800
Q-2 (April)	235	152	83	5,200	430,300	210,000	640,300
Q-3 (July)	235	149	86	5,200	447,200	210,000	657,200
Q-4 (Oct)	235	77	159	5,200	824,200	210,000	1,034,200
<b>Total Annual Inventory Cost</b>							<b>3,550,500</b>

Source: Survey Data (F&L Furniture, 2013)

The results in Table 3 and Table 6 of total annual inventory costs can be interpreted as follows. By using the existing policy, there are 3 orders per year took place of 668 units of chip boards and the total annual cost is 4,103,600 kyats. On the other hand, the probabilistic model is obvious to search for the optimal number of replenishments, 235 units, and optimal timing, 4 times per year and its total annual inventory cost is 3,550,500 kyats.

Two calculations are now considered to analyze the optimization of the total annual inventory costs for F&L furniture. These indicate that

- ordering times and annual ordering costs of proposed model are more than these of existing policy
- annual holding cost of proposed model is less than that of existing policy and
- total annual inventory cost of using the model is 553,100 kyats less than cost of existing policy
- Hence, the proposed model obtains the optimal total annual inventory cost and optimal solutions.

Last but not least, F&L should ensure that they adopt the technique of ABC analysis and periodic review model with probabilistic demand which helps to minimize inventory cost, in ordering and reordering of all inventory items.

## **Conclusion**

Inventory management is critical for most companies, but is especially crucial for small businesses when compared with large companies, they usually have limited resources and bargaining power, which have negative effects on the way inventory can be managed.

Many small businesses face great challenges in managing inventory when they seek developments. This paper is trying to connect theories with a real case and propose managerial solutions that the business firm, Faith & Love Furniture, can implement to improve its inventory management.

Nevertheless, many inventory situations possess complications that are not taken into account by the models in this paper. More complex models have been formulated in an attempt to fit such situations, but it is difficult to achieve both adequate realism and sufficient tractability to be useful in practice. The development of useful models for inventory management currently is a particularly active area of research. Further study and research, hence, are needed for continue growth which is occurring in the computerization of inventory data processing, along with an accompanying growth in scientific inventory management.

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