A Case Study of Inventory Analysis in a Healthcare Product Manufacturing Company

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Abstract **--- A worldwide market inventory is one of the biggest and most significant resources of a manufacturing industry. ABC analysis is one of the techniques used comprehensively in manufacturing industries for inventory classification. The ABC inventory classification technique has an efficient control on a huge amount of inventory items. The ABC inventory classification approach categorizes inventory items as A, B and C classes according to their annual consumption value. To direct and control the inventory items more proficiently the inventory managers regularly classify and group all the inventory items. Thus, in this paper, we concentrate on inventory management in a healthcare product manufacturing company in Kedah, Malaysia. A case study approach is used to make a preliminary inventory assessment through ABC analysis in order to control the inventory items more efficiently.**

Keywords--- ABC analysis, inventory management, healthcare product manufacturing company.

1. Introduction

Effective distribution company management revolves around balancing the three key dimensions of inventory, cost, and service. Managing these trade-offs efficiently is a typical inventory management task which can effect for company in improving business performance and driving competitive advantage in a worldwide market.

Inventory management is the main component in supply chain management. It involves a stability between customer service, or product availability, and the cost of inventory [1]. The concept that high inventories are inefficient has been widely established [2], and companies now concentrate on improving inventory efficiency. Managing inventory effectively can make inventory data can be accessed much easily [3].

By definition, inventory refers to the goods or material used by company for production. Inventory control refers to coordinating availability, controlling, utilization and procuring of materials. Inventory control is the course along activities with the objective of getting to the right inventory in the right place at the right time and in the right quantity and it is directly connected to the production functions of any organization.

The requirement for the production the products is to present the problems, facing by the companies in material requirements and to provide proper material management. For this, assessment of problems in manufacturing companies, in term of inventory management will be evaluated through different market survey, using questionnaire, interview, and literature review. For data analysis, quantitative analysis includes inventory model like ABC technique will be applied in acquiring data.

Material management is an essential management tool which will be improving the productivity of a manufacturing industry. A poor management of materials can impact on overall production, time, cost and quality. Manufacturing management is the overall planning, sourcing, purchasing, moving, storing, coordinating and controlling the materials form starting to the end. The objective is to produce a functionally and financially feasible product.

In Malaysia, most manufacturing companies face several issues that need to be resolved, which includes the increase of inventory cost, on-time delivery, and inventory shortage [4]. Modern businesses may carry inventories of a large variety of items such as finished goods, spare parts, and raw materials. Sometimes the numbers will run into the thousands. Managing these inventories involves answering, for example, how much to order and when to order. Answers to these questions have to be based on an analysis of demand and lead time. Doing this one at a time for every item is neither efficient nor cost-effective, yet inventories have to be managed. They are often the biggest manageable costs of production and represent significant portions of a company's assets.

Consequently, this paper proposes to improve the study of inventory management through a case study of the healthcare product manufacturing company. It suggests a number of inventory assessment methods. Hence, in this paper uses an ABC analysis as a technique for prioritizing the management of inventory. Inventories are categorized into three classes - A, B, and C. Most

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management efforts and oversights are expended on managing A items. C items get the least attention and B items are in-between.

Conventionally, ABC analysis has been based on the criterion of dollar volume and on the principle that there are a relatively small number of items - category A - that account for the bulk of the dollar volume. At the other extreme, a large number of items - category C - account for a small share of the dollar volume. Category B items are between categories A and C, both in number and dollar volume. By this criterion, A items are those of both high-value and high-demand and C items are low-value and low-demand.

2. Literature Review

Inventory management is the continuing process of planning, organizing and controlling inventory that aims at minimizing the investment in inventory while balancing supply and demand. The inventory expressed in terms of the number of days of sales at any point of time determines the time taken to introduce a new product in market [5]. The inventory concepts and advantages of ABC classification were analysed and the various steps implemented using the ABC analysis for analysing the original case was discussed.

The ABC analysis was found to be useful to most of the companies already in usage of this tool either manually or with an enterprise resource planning system [6-8]. A study was carried out by [9] with ABC analysis in an automotive industry for utilizing the maximum effect of cost savings. Through research and statistical calculations a proposal was made to reduce costs bound in the inventories of the companies. The new system of inventory management facilitated companies to utilize the saved money in another way and to achieve further optimization of the processes [10-11].

ABC analysis defined by [12] as a technique for inventory management, which enables top management to place the effort where the result will be the highest. ABC analysis, which is based on Pareto principles. It assumes that 20% of products covers 80% of share in general demand for goods [13]. This method provides focus on the materials whose supply takes higher positions in total value of material consumption and total value of turnover in companies [14]. It divides warehouse product range into three categories. The first category is a group of 20% of goods marked A, including items of highest (80%) share in general supply. The second group is formed by the goods whose share in total supply amounts to more than 80%, marked B. Third group, marked C, encompasses the rest of goods, whose share in total supply amounts more than 90% [13].

Moreover, ABC method of categorization of inventory items allows to focus on most expensive items [15]. The obtained results aim to indicate items whose purchase and storage in the warehouse is the most or the least beneficial for companies. The results of analysis might help identify these machines and equipment which are most prone to failure. Use of ABC method allows for planning of material demand towards most profit-generating goods with higher stock rotation rates. Detailed description of ABC method will be provided in the form of case study for warehouse in a manufacturing company.

Thus, in this paper, under the ABC technique, we measured a highest value of annual sales is kept in category A; lowest value of annual sales is kept in category C and medium value of annual sales is kept in category B. The monetary percentages of each individual category are mentioned in the bullets below:

- Category A: 5% to 10% of the items represent 70% to 75% of the money value.
- Category B: 15% to 20% of the items represent 15% to 20% of the money value.
- Category C: The remaining number of the items represent 5% to 10% of the money value.

3. Research Methodology

In this study, case study research method is applied. Both quantitative and qualitative inventory management methods have been examined in the case analysis. Quantitative methods employ mathematical models to manage inventory, while qualitative methods use conceptual ideas from supply chain management to reduce inventory. It is expected to arrive at a deep understanding of how inventory management is done, and what factors influence the efficiency and effectiveness of inventory management to reduce costs, improve service, and enhance competitive advantage.

In this paper, we have focused on ABC analysis for analysing of inventory management in a healthcare product manufacturing company. Firstly, we visited the company for data collection. The data collected by interviewing managers and his staff who are involved in inventory management. Other data are collected by studying company documentation, such as production schedules, inventory reports, production reports, ERP databases, and public media such as the internet and newspapers. Then, the raw data were filtered into required information. Figure 1 shows the overall methodology decided for this paper. After data collection, with the help of Microsoft Excel, the ABC analysis was performed.

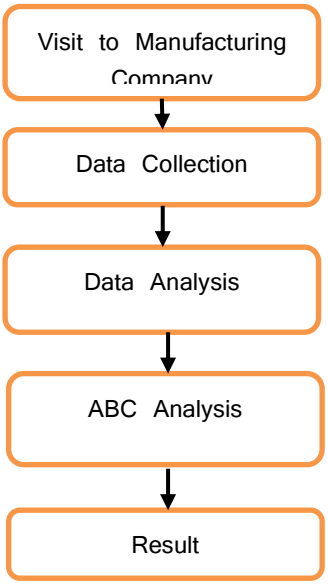


Figure 1. Methodology Flow Chart

4. ABC Analysis

This case study is developed from actual data gathered from the company. However, in order to protect the interests of the company so that the company identity remains anonymous, we use PISB (pseudonym) as a company's name throughout the study. PISB is one of the manufacturers producing the healthcare and cosmetic products. PISB had registered as an SME of the pioneer manufacturer and distributor of health products, traditional medicines and cosmetic products using herbal and sea cucumber (gamat) as the active ingredients. PISB had been selling their products in a variety of retail stores covering almost all over in Malaysia. By the year 2005, PISB produced a total of 128 products. These products were separated into four categories as listed below:

i) Healthcare Product
ii) Cosmetic Product
iii) Oily and Balm Product
iv) Herbs Medicinal Product

As the company operates with hundreds of products, it is good to cut the quantity of goods to the most essential ones. Undoubtedly, that main product is traditional medicines and healthcare products. Within current research following key indicators are selected: total year revenue, one item sales price and total amount of sales. Based on 2014 production data, the list of PISB products consists of 43 items (some items are grouped before the analysis, as well some seldom and special items are ignored as not typical in daily operations). However, for the ABC analysis, we have selected only 22 items because of some items have not sufficient data information.

ABC classification by total year revenue is very essential for the company as it shows items which require most assets into inventory. These items should be controlled as tight as possible, i.e. low inventory levels and safety stocks to minimize costs. Performing ABC classification by price is less important than total year revenue, however is still useful. As group A needs a high level of safety to protect it from any damage. ABC classification by demand has a similar nature with classification of total year revenue. Besides, group A items should be held in the most accessible place in the warehouse as they are the most demanded.

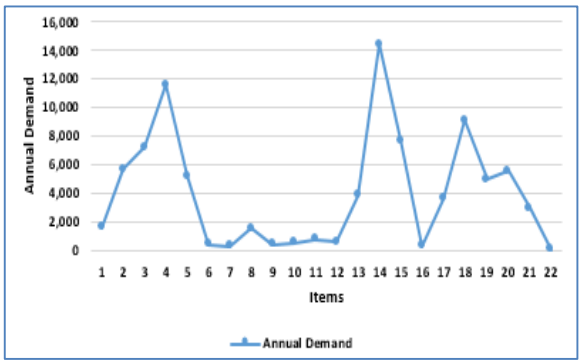
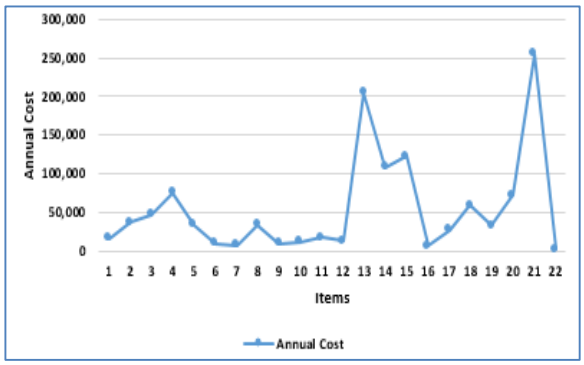


Figure 1: ABC analysis on annual demand

An illustration of ABC analyses is shown in Figure 1 and Figure 2. For comparing analysis, we can conclude that both ABC analysis of annual demand and annual cost show almost the same result, which is close to theoretical ABC breakdown. In spite of the items in both Groups A are almost the same, they have different ranking. ABC analysis by items total price shows different results as the nature of key parameter is different. The most essential items for the company based on ABC analysis Jeli Pati Gamat, Krim Seri Gamat, Minyak Belacak, Balsam Serai, PISB Seri Wajah and Minyak Seri Gamat.

Figure 2: ABC analysis on annual cost



Furthermore, Table 1 below shows data collection for the PISB products. Column 1 of Table 1 shows the items names, whereas the column 2 represents the annual demand of the respective item. Column 3 represents the annual percentage of the respective item, whereas the unit cost is mentioned in column 4. The respective item annual cost is indicated in column 5 of Table 1.

For ABC analysis, annual cost, annual usage percentage and annual usage cumulative percentage are the deciding factors. These factors are shown in column 6, 7, and 8 of Table 1 respectively. The items are classified on the basis of the steps mentioned below:

i) Categorise items and find its use in units and unit price.
ii) Find the total value of every item by taking the product of the expected units by its unit price.
iii) Rank the item according to the highest total value.
iv) Compute the percentages of the number of units of each item to total units of all items and the ratio of the total value of each item to the total value of all items.
v) Add together the items on the basis of their relative value to form A, B and C categories.

5. Result and Discussion

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

Table 1: Data collection for the PISB products

No	Items	Annual Demand	Annual Percentage	Unit Price (RM)	Annual Cost (RM)	Annual Usage (%)	Annual Usage Cumulative (%)
1	Air Seri Gamat	1,600	1.80	10.00	16,000	1.33	1.33
2	Balsam Gamat	5,700	6.42	6.50	37,050	3.08	4.40
3	Balsam Halia	7,200	8.11	6.50	46,800	3.89	8.29
4	Balsam Serai	11,600	13.07	6.50	75,400	6.26	14.55
5	Balsam Seri Pala	5,200	5.86	6.50	33,800	2.81	17.36
6	Femi Herb II	455	0.51	21.90	9,965	0.83	18.18
7	Femi Herb Kapsul	319	0.36	21.90	6,986	0.58	18.76
8	Herba Munasir	1,554	1.75	21.90	34,033	2.83	21.59
9	Herba Perkasa	465	0.52	21.90	10,184	0.85	22.44
10	Herba Rangin	560	0.63	21.90	12,264	1.02	23.45
11	Herba Seri K. Fatimah	793	0.89	21.90	17,367	1.44	24.90
12	Herba Tongkat Ali	600	0.68	21.90	13,140	1.09	25.99
13	Jeli Pati Gamat	3,851	4.34	53.00	204,103	16.95	42.93
14	Krim Seri Gamat	14,438	16.26	7.50	108,285	8.99	51.92
15	Minyak Belacak	7,680	8.65	16.00	122,880	10.20	62.13
16	Minyak Munasir	330	0.37	21.00	6,930	0.58	62.70
17	Minyak Seri Cengkih	3,641	4.10	7.50	27,308	2.27	64.97
18	Minyak Seri Gamat	9,102	10.25	6.50	59,163	4.91	69.88
19	Minyak Seri Pala	5,002	5.63	6.50	32,513	2.70	72.58
20	PISB Seri Wajah	5,579	6.28	13.00	72,527	6.02	78.60
21	Tonik Herba Gamat	3,004	3.38	85.00	255,340	21.20	99.80
22	Twiss Night Oil	112	0.13	21.00	2,352	0.20	100.00
		88,785			**1,204,388**		

Table 2: ABC analysis based on total year revenue

No	Items	Annual Cost (RM)	Annual Usage (%)	Annual Usage Cumulative (%)	Category
1	Tonik Herba Gamat (Sea Cucumber)	255,340	21.20	21.20	A
2	Jeli Pati Gamat (Sea Cucumber)	204,103	16.95	38.15	A
3	Minyak Belacak (Massage Oil)	122,880	10.20	48.35	A
4	Krim Seri Gamat (Cream & Balm)	108,285	8.99	57.34	A
5	Balsam Serai (Cream & Balm)	75,400	6.26	63.60	A
6	PISB Seri Wajah (Massage Oil)	72,527	6.02	69.62	A
7	Minyak Seri Gamat (Massage Oil)	59,163	4.91	74.54	A
8	Balsam Halia (Cream & Balm)	46,800	3.89	78.42	B
9	Balsam Gamat (Cream & Balm)	37,050	3.08	81.50	B
10	Herba Munasir (Herbal Capsule)	34,033	2.83	84.32	B
11	Balsam Seri Pala (Cream & Balm)	33,800	2.81	87.13	B
12	Minyak Seri Pala (Massage Oil)	32,513	2.70	89.83	B
13	Minyak Seri Cengkih (Massage Oil)	27,308	2.27	92.10	B
14	Herba Seri K. Fatimah (Herbal Capsule)	17,367	1.44	93.54	B
15	Air Seri Gamat (Sea Cucumber)	16,000	1.33	94.87	B
16	Herba Tongkat Ali (Herbal Capsule)	13,140	1.09	95.96	C
17	Herba Rangin (Herbal Capsule)	12,264	1.02	96.98	C
18	Herba Perkasa (Herbal Capsule)	10,184	0.85	97.82	C
19	Femi Herb II (Herbal Capsule)	9,965	0.83	98.65	C
20	Femi Herb Kapsul (Herbal Capsule)	6,986	0.58	99.23	C
21	Minyak Munasir (Massage Oil)	6,930	0.58	99.80	C
22	Twiss Night Oil (Massage Oil)	2,352	0.20	100.00	C

6. Conclusion

Improper inventory management leads to cost overruns as well increases time delays. Thus, inventory management is an important sector of logistics and economic spheres, the company's growth and success is strictly dependent on it. Even empiric experience may help to manage inventory well, application of managerial theory allows analysing future improvements. There is a variety of inventory management strategies all answering the same questions, i.e. When to order? And how much to order? To response them, different approaches can be applied, namely inventory models, simulation, and optimisation.

Traditionally, inventory strategies expressed by means of analytic formulas are the most popular. However, a complexity of analytic inventory models increases if stochastic data appears such as demand and lead time. So, the computation of the optimal order quantity will be more complex. Application of analytical formulas is only then valuable, if there is no necessity for complex adoption inventory models for any certain case which requires from a manager good mathematical skills and creativity.

Hence, in this study, we used ABC classification as an important technique to categorize the inventory in three different classes depending on their significance. The case study focuses on inventory management in a healthcare product manufacturing company in Kedah, Malaysia. A case study approach is used to make a preliminary inventory assessment through ABC analysis in order to control the inventory items more efficiently. An empirical study is conducted to analyse the current situation of the inventory management in the company. As a result, it showed that seven products are categorized in Class A, eight products are categorized in Class B whereas seven products are categorized in Class C.

For some further research directions approach, the main important for the company to consider is that the company operated with dependent products, it is necessary to make a review of inventory models which deal with dependent products. Moreover, to react fast on rapidly changing environment, forecasting methods have to be considered before planning inventory. Till now demand forecasting is only based on the manager competencies. In spite of the fact that this practice has worked well, the necessity of implementing a forecasting is obvious.

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References

[1] Ballou, R. H. (1998). *Business logistics management* (4th ed.). London: Prentice-Hall.

[2] Christopher, M. (2016). *Logistics and supply chain management* (5th ed.). Harlow: Pearson Higher Education.

[3] Rahim, M. K. I. A., & Aghezzaf, E. H. (2012). Implementing a vendor managed inventory policy in a two-stage supply chain with stochastic demands. In *14th IFAC Symposium on Information Control Problems in Manufacturing (INCOM-2012)* (pp. 602-607).

[4] Radzuan, K., Rahim, M. K. I. A., Anuar, H. S., Nawi, M. N. M., & Osman, W. N. (2015). *Inventory Management Practices and Its Effects on Vendor Managed Inventory Performance*. Advanced Science Letters, 21(6), 2114-2117.

[5] Wei, Y., Wang, H., & Qi, C. (2013). "*On the stability and bullwhip effect of a production and inventory control system"*, International Journal of Production Research, Vol. 51, pp.154-171.

[6] S. Nallusamy, (2016), *"A proposed model for sustaining quality assurance using TQM practices in small and medium scale industries"*, International Journal of Engineering Research in Africa, Vol. 22, pp. 184-190.

[7] Smith, (2011), *"Inventory management and ABC analysis practices in competitive environments"*, International Journal of Procurement Management, Vol. 4(4), pp. 433-454.

[8] S. Nallusamy, (2016), *"A proposed model for lead time reduction during maintenance of public passenger transport vehicles"*, International Journal of Engineering Research in Africa, Vol. 23, pp. 174-180.

[9] Nallusamy, S., Balaji, R., & Sundar, S. (2017). *Proposed model for inventory review policy through ABC analysis in an automotive manufacturing industry.* In International Journal of Engineering Research in Africa (Vol. 29, pp. 165-174). Trans Tech Publications.

[10] Kampf, R., Lorincová, S., Hitka, M., & Caha, Z. (2016). *"The application of ABC analysis to inventories in the automatic industry utilizing the cost saving effect"*, Journal of Marine Sciences, Vol. 63(3), pp. 120-125.

[11] Nallusamy, S., Balakannan, K., Chakraborty, M. G., & Majumdar, G. (2015). *Reliability analysis of passenger transport vehicles in public sector undertaking*. International Journal of Applied Engineering Research, 10(68), 843-50.

[12] Mahant, H., Chouhan, S. S., & Yadav, A. (2013). *Inventory Management by Implementation of ABC Analysis upon Medium Scale Industry*. International Journal of Scientific Research (2(8): 162-165.

[13] Lysons, K. (2004). *Procurement Purchasing*, PWE, Warsaw, p. 221.

[14] Gubala M., & Popielas J. (2005), *Fundamentals of Warehouse Management*. Wydanie II, Biblioteka Logistyka, Poznań, p. 74.

[15] Sarjusz–Wolski Z. (1998), *Strategy of Supply Management. Practice of Business Logistics. Short-term Demand Forecasting. Material Resource Planning, Inventory Management*, Agencja Wydawnicza PLACET, Warsaw, p. 96.