INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD ISSN: 2455-0620 Volume - 5, Issue - 8, Aug – 2019
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value: 86.87 Impact Factor: 6.497
Received Date: 20/08/2019 Acceptance Date: 30/08/2019 Publication Date: 31/08/2019

Analysis of Forecasting Techniques of Yathar Cho Industry Limited

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Abstract: *This paper is about the forecasting techniques of Yathar Cho Industry Limited (YUM YUM INSTANT NOODLE), Myanmar. Forecasting is a technique that uses historical data as inputs to make informed estimates that are predictive in determining the direction of future trends. Businesses utilize forecasting to determine how to allocate their budgets or plan for anticipated expenses for an upcoming period of time. The main aim of this paper is to show the forecasting techniques of yum yum noodle. The forecasting techniques is shown on two ways. The first way is the calculating of mean absolute percent Error calculating using the two period moving average method. The second way is the calculating of mean absolute percent error using exponential smoothing method.*

Key Words: *Yathar Cho Industry Limited, Two-period moving average, Exponential Smoothing, Mean absolute percentage error.*

1. INTRODUCTION:

A forecast is a statement about the future value of a variable such as demand. That is, forecasts are predictions about the future. The better those predictions, the more informed decisions can be. Some forecast are long range, covering several years or more. It describes the elements of good forecasts, the necessary steps in preparing a forecast, basic forecasting techniques and how to monitor a forecast.

Two aspects of forecasts are important. One is the expected level of demand; the other is the degree of accuracy that can be assigned to a forecast (i.e., the potential size of forecast error). The expected level of demand can be a function of some structural variation, such as a trend or seasonal variation Forecast accuracy is a function of the ability of forecasters to correctly model demand, random variation and sometimes unforeseen events.

Forecasts are the basic for budgeting, planning capacity, sales, production and inventory, personnel, purchasing, and more. Forecasts play an important role in the planning process because they enable managers to anticipate the future so they can play accordingly. Forecasts affect decisions and activities throughout an organization, in accounting, finance, human resources, marketing, and management information system (MIS).

2. CASE STUDY:

A case study is made at Yathar Cho Industry Limited (YUM YUM Instant Noodle), located at No (197,198,199), 10th Street, Yangon, Myanmar, which manufactures three different types of products. They are Original, Xcite and Premium. The machine can produce approximately 6000 boxes for one small production line and about 12000 boxes for large production line. For a day, they can produce around 35000 bags depending upon customer demand. The information and data are obtained from this factory for this paper.

3. MANUFACTURE:

A. Functionally of raw materials/ ingredients

The main ingredients for instant noodles are wheat flour, salt or kansui (alkaline salt mixture of sodium carbonate, potassium carbonate and sodium phosphate), and water. Other ingredients like starch, gums, emulsifiers, stabilizers, antioxidants, coloring and flavoring agents are also added to improve the texture and eating quality. Nowadays instant noodles are also fortified with protein, minerals and vitamins to improve their nutrition value.

B. Role of critical unit operations

Noodle processing typically comprises mixing raw materials, resting the crumbly dough, sheeting the dough into two dough sheets, compounding the sheets into one, gradually the sheet into a specified thickness and slitting into noodle strands. For instant noodle preparation, strands are steamed and dehydrated by drying or frying followed by cooling and packing with the seasonings.

- Mixing: Ingredients other than flour are pre dissolved in water, stored at 20-30 ºC while salt water can be prepared separately. Wheat flour and water along with other weighted ingredients are mixed first at high speed and then a low speed, giving a total time of 15-25 minutes in industries. The mixing time, however also depends on the type of mixer used. Mixing is also influenced by the quality of flour, volume of water added, presence or absence and amount of certain ingredients (especially salt and alkaline salt) and temperature and humidity of processing environment. Mixing is usually followed by dough resting. Resting improves processing properties and facilitates gluten formation during sheeting.
- Sheeting : After mixing, the crumbly dough is compress to form continuous dough sheet, which is folded or compounded and passed through subsequent rolls. The sheeting process is intended to achieve a smooth dough sheet with desired thickness, and a continuous and uniform gluten matrix in dough sheet. Dough sheet are rest to allow gluten structure relaxation or mellow the gluten and make it more extensible by slow passage or zigzag conveyor in automobile plants.
- Cutting / Slitting and Waving : The dough sheet is cut into noodle strands of desired width with a slitter. The width and shape of noodle strands are determined by cutting rolls. The speed differential between noodle feeding and net travelling result in a unique waving of noodle strands. Noodle strands are cut into a desirable length by a cutter.
- Steaming and Moulding: The cut and way noodle strands are conveyed to a steam chamber to cook them by exposing to a temperature of 100ºC for one-five minutes. The degree of cooking during steaming is critical and depends on the original moisture content of noodle; amount, pressure and temperature of steam and steaming time. Under steamed noodles will have a hard core and will be difficult to cook properly, whereas over steamed noodles are soft and sticky. Steaming is a key process in the manufacture of instant noodles. The cut noodles are placed in moulder of square, round, bowl, or cup shape, depending on the desired product shape before moving to the fryer or drier.
- Frying / Drying : After steaming and molding, noodle blocks are fed into frying baskets, which are mounted on the traveling chain of a tunnel fryer. The baskets filled with noodle blocks are immersed in hot oil for deep frying. Noodles drying can also be done by hot air to produce instant dried noodles. Frying is the preferred method of drying as nonfried instant noodles require a longer cooking time.
- Packaging : Frying or drying is followed by cooling the product to room temperature to avoid rapid oxidation and other changes. The cooled noodles are packed into a bag along with a soup base sachet. While for the cup noodles, powdered soup base is sprinkled over the noodles and sealed with shrink film. Seasonings and dehydrated vegetables are included in soup base. Higher fat content makes the noodles susceptible to oxidative changes and development of rancid flavour. Thus, proper packaging plays important role in extending the shelf life of the product. The packaging material used for noodles are polypropylene or polyethylene film for bag noodles and polyester for cup noodles.

Figure 1. New product of YUM YUM instant noodle

Figure 2. Wheat flour brands

4. RESEARCH METHODOLOGY:

Data sheets were gathered for raw materials for the duration of three months. These data had been taken by the department of planning and a total of various wheat flour brands are checked from the production department. There are many different kinds of forecasting methods and inventory formulas in operation planning. For forecasting, the two most important factors are cost and accuracy. Two-period moving average and exponential smoothing are used to make forecast and forecast accuracy. For inventory management, the goal in ordering is to place an order when the amount on hand is sufficient to satisfy demand during the time it takes to receive that order (i.e., lead time).

A. Forecasting Methods

Demand forecasting is important components of yield management, which relates to the percentage of capacity being used. There are two uses for forecasts. One is to help managers plan the system and the other is to help the use of the system. Forecasting techniques based on time series are made on the assumption that future values of the series can be estimated from past values. Three techniques for averaging are:

Moving average,

$$F_t = \mathrm{MA}_n = \frac{\sum_{i=1}^{n} A_{t-i}}{n} = \frac{A_{t-n} + \cdots + A_{t-2} + A_{t-1}}{n} \quad (1)$$

Weighted moving average,

$$F_t = w_t(A_t) + w_{t-1}(A_{t-1}) + \ \ldots + \ w_{t-n}\,(A_{t-n}) \quad (2)$$

Exponential Smoothing

$$F_t \ = \ F_{t-1} + \ \alpha\,(\,A_{t-1} - \ F_{t-1}\,) \quad (3)$$

Forecast accuracy is significant factor when deciding among forecast alternatives. Accuracy is based on the historical error performance of forecast. Three commonly used measures for summarizing historical errors are the mean absolute deviation (MAD), the mean squared error (MSE), and the mean absolute percent error (MAPE). Difference between these measures is that MAD weights all errors evenly, MSD weights error according to their squared values, and MAPE weights according to relative error. Forecast error is the difference between the value that occurs and the value that was predicted for a given time period.

Hence, Error = Actual-Forecast,

$$\mathrm{MAD} = \frac{\sum|\mathrm{Actual}_t - \mathrm{Forecast}_t|}{n} \quad \text{or MAD} = \frac{\sum|e|}{n} \quad (4)$$

$$\mathrm{MSE} = \frac{\sum(\mathrm{Actual}_t - \mathrm{Forecast}_t)^2}{n-1} \quad \text{or MSE} = \frac{\sum|e^2|}{n-1} \quad (5)$$

$$\mathrm{MAPE} = \frac{\sum[\frac{|e|}{\mathrm{Actual}} \mathrm{x} 100]}{n} \quad (6)$$

Where,

F_t = Forecast for time period t

MA_n = n period moving average

A_{t-1} = Actual value in period t – 1

n = Number of periods (data points) in moving average

W_t = Weight for the period t

W_{t-1}= Weight for period t – 1

A_t = Actual value in period t

A_{t-1} = Actual value for period t – 1

F_{t-1} = Forecast for the previous period (i.e., t -1)

α = Smoothing Constant

A_{t-1} = Actual demand or sales for previous period

5. RESULT AND DISCUSSIONS

(1) Calculating the forecast of wheat floor by using two-period moving average and exponential smoothing of Yathar Cho Industry. Wheat flour (1bag = 40kg)

A. Wheat Flour Forecasting based on monthly by using two-period and five- period moving average. All units were shown in tonnes. These forecast results were come from using the equation (1) and forecast accuracies were gained from using equation (4), (5) and (6).

Table 1. Forecasting of wheat flour

Month	Actual Demand	Two-period moving average		Five-period moving average	
		Forecast	Error	Forecast	Error
Jan	898	-	-	-	-
Feb	881	-	-	-	-
Mar	849	889.5	-40.5	-	-
Apr	879	865	14	-	-
May	888	864	24	-	-
June	831	883.5	-52.5	879	-48
July	817	859.5	-42.5	865.6	-48.6
Aug	906	824	82	852.8	53.2
Sep	933	861.5	71.5	864.2	68.8
Oct	895	919.5	-24.5	875	20
Nov	887	914	-27	876.4	10.6
Dec	831	891	-60	887.6	-56.6
Jan	-	859	-	890.4	-
MAD		43.85		43.69	
MSE		2638		2658	
MAPE		5.029%		5.03%	

Figure 3. The more periods in moving average, the greater the forecast will lag (slow) changes in the data

A moving average forecasts uses a number of the most recent actual data values in gathering a forecast. The moving average can incorporate as many data points as desired. The advantages of a moving average forecast are that

it is easy to compute and easy to understand. A possible disadvantage is that all values weighted equally. For instance, in a 10 period moving average, each value has a weight of 1/10. In selecting the number of periods to include, we must take into account that the number of data points in the average determines its sensitivity to each new data point: The fewer the data points in an average, the more sensitive (responsive) the average tends to be. That is why, two- period moving average is more sensitive (responsive) than five-period moving average. If responsiveness is important, a moving average with relatively few data points should be used. This will permit quick adjustment to say, a step change in the data but it also will cause the forecast to be somewhat responsiveness even to random variations. Conversely, moving data points with five-period moving average will smooth more but less responsive to "real" changes. A review of forecast errors can help in this decision. Accuracy and control of forecasts is a vital aspect of forecasting, so forecasters want to minimize forecast errors. If lowest MAD is the criterion, the five-period moving average has the greatest accuracy; if lowest MSE is the criterion, two-period moving average works best; and if lowest MAPE is the criterion, the two-period moving average method is again best. Of course, it seems that two-period moving average performs better than five-period according to MSE, MAPE.

B. Wheat flour forecasting based on monthly by using exponential smoothing. All units were shown in tonnes. These results were come from using the equation (3).

Table 2. Calculation of wheat flour

Month	Actual	α = 0.1	α = 0.2	α = 0.3	α = 0.4
Jan	898	-	-	-	-
Feb	881	898	898	898	898
Mar	849	896.3	894.6	892.9	891.2
Apr	879	891.6	885.5	879.7	874.3
May	888	890.3	884.2	879.5	876.2
June	831	890.1	885	882.1	880.9
July	817	884.2	874	866.8	860.9
Aug	906	877.5	862.6	851.9	843.3
Sep	933	880.4	871.3	868.1	868.4
Oct	895	885.7	883.6	887.6	894.2
Nov	887	886.6	886	889.8	894.5
Dec	831	886.6	886.2	889	891.5
Jan	-	881	875.2	871.6	867.3
MAD		31.99	32.42	32.56	33.24
MSE		1745.6	1745.9	1794.5	1846.9
MAPE		3.74%	3.76%	3.76%	3.84%

Table 3. Calculation of Wheat Flour

Month	α = 0.5	α = 0.6	α = 0.7	α = 0.8	α = 0.9
Jan	-	-	-	-	-
Feb	898	898	898	898	898
Mar	880.5	887.8	886.1	884.4	882.7
Apr	869.3	864.5	860.1	856.1	852.4
May	874.2	873.2	873.3	874.4	876.3
June	881.1	882.1	883.6	885.3	886.8

July	856.1	851.4	846.8	841.9	836.6
Aug	836.6	830.8	825.9	822	819
Sep	871.3	876	882	889.2	897.3
Oct	902.2	910.2	917.7	844.2	929.4
Nov	898.6	901.1	901.8	884.8	898.4
Dec	892.8	892.6	891.4	886.6	888.1
Jan	862	855.6	849.1	842.1	836.7
MAD	33.9	35.79	36.28	37.28	35.45
MSE	1823.4	1914.7	1966.3	2052.7	1918.4
MAPE	3.9%	4.12%	4.17%	4.28%	4.07%

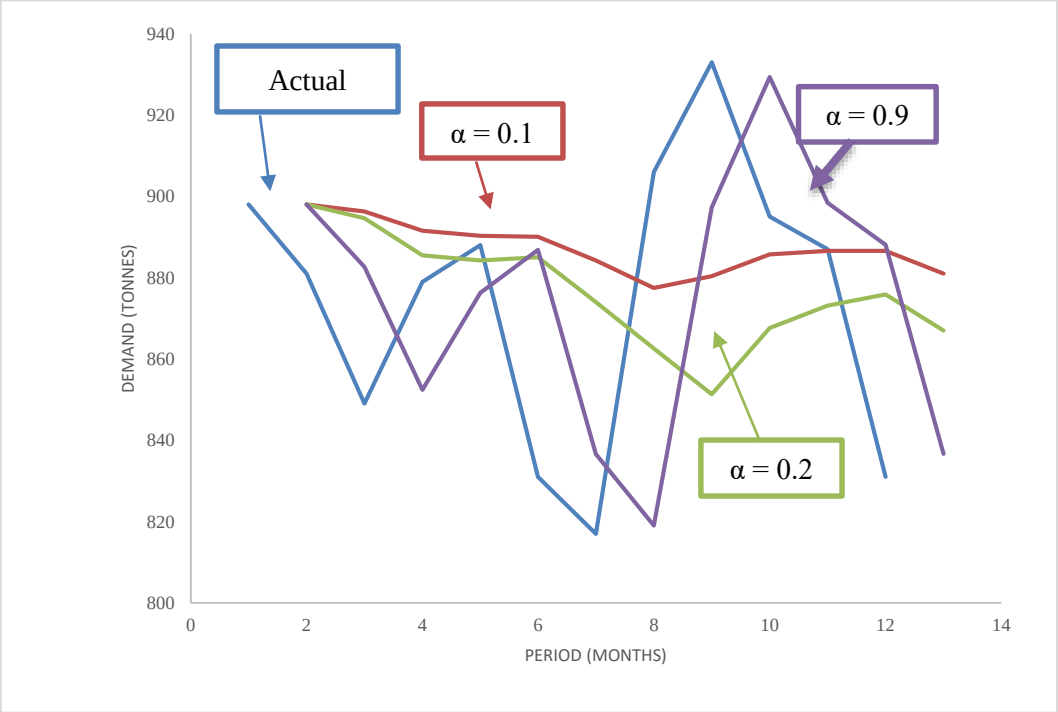

Figure 4. The closer α is zero, the greater the smoothing

Exponential smoothing is a sophisticated weighted averaging method that is still relatively easy to use and understand. Exponential smoothing is one of the most widely used techniques in forecasting, partly because of its ease of calculation, and partly because of the ease with which the weighting scheme can be altered-simply by changing the value of α. Each new forecast is based on the previous forecast plus a percentage of the difference between that forecast and the actual value of the series at that point. The quickness of forecast adjustment to error is determined by the smoothing constant error, α.

The closer its value is to zero, the slower the forecast will be adjust to forecast errors (i.e., the greater the smoothing). Conversely, the closer the value of α is to 1.00, the greater the responsiveness and the less the smoothing. That is why, the value of α = 0.1 is more smoothing whereas the value of α = 0.9 is more responsiveness and similar to actual trend. This is illustrated in figure 4. The goal is to select a smoothing constant that balances the benefits of smoothing random variations with the benefits of responding to real changes if and when they occur.

Commonly used values of α range from .05 to .50. Low values of α are used when the underlying average tends to be stable; higher values are used when the underlying average is susceptible to change. Selecting a smoothing constant is basically a matter of judgement or trial and error, using forecast errors to guide the decision. From all of these data in exponential smoothing, α = 0.1 is the greatest accuracy because of the lowest MAD, MSE and MAPE.

C. Comparison of forecast accuracy of wheat flour

One use for these measures is to compute the accuracy of alternative forecasting methods. For instance, we could compare the results to determine to one which yields the lowest MAD, MSE or MAPE for a given set of data. MAD is the easiest to compute, but weights errors linearly. MSE squares errors, thereby giving more weight to larger errors, which typically cause more problems. MAPE should be used when there is a need to put errors in perspective. Comparison of two-period moving average and exponential smoothing, the value of $\alpha = 0.1$ is the best accuracy.

Table 4. Comparison of forecast accuracy

Methods	Two-period Moving average	Exponential Smoothing		
		$\alpha = 0.1$	$\alpha = 0.2$	$\alpha = 0.3$
Mean Absolute Deviation (MAD)	43.85	31.99	32.42	32.56
Mean Squared Error (MSE)	2638	1745.6	1745.9	1794.5
Mean Absolute Percent Error (MAPE)	5.029%	3.74%	3.76%	3.76%

6. CONCLUSION:

The paper is studied on the operation planning of Yathar Cho Industry Limited (YUM YUM Instant Noodle Factory). Planning is the integral part of manager's job. If uncertainties cloud the planning horizon, managers will find it difficult to plan effectively. Forecasts help managers by reducing some of the uncertainty, thereby enabling them to develop more meaningful plans.

A forecast is a statement about the future value of a variable such as demand. That is, forecasts are predictions about the future. The better those predictions, the more informed decisions can be. These are especially helpful in operation planning and scheduling day-to-day operations. This paper also describes the elements of good forecasts, the necessary steps in preparing a forecast, basic forecasting techniques, and how to monitor a forecast for wheat flour. Moreover, if demand was much less than the forecast, an action such as a price reduction or a promotion may be needed. If demand was much more than the forecast, increased output may be advantageous.

This may involve working overtime, outsourcing, or taking other measures. Inventory management is also a core operation planning activity. Inadequate control of inventories can result in both under and overstocking of items. Understocking results in missed deliveries, lost sales, dissatisfied customers, and production bottlenecks; overstocking unnecessarily ties up funds that might be more productive elsewhere. If these procedures in operation fulfilled that requirement by operation planning, the factory will get the material smoothing and without interruption for operation process, prevent stock-out.

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