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Operations Decisions for a small Bakery shop with high Seasonal Demand

DINESH KUMAR[1] & SRIDHAR K[2]

[1]*Scholar, Chhatrapati Shivaji Institute of Technology, Durg, Chhattisgarh, India*

[2]*Professor in Mechanical Engineering, Chhatrapati Shivaji Institute of Technology, Durg, Chhattisgarh, India*

Abstract: The abnormal economic conditions, global competition, customer's aspiration has a major impact on the performance of the enterprises. Operation decisions are essential for proper planning in order to achieve the goal of the enterprise. In this Project, an attempt to an attempt is to make to arrive the operation decisions in a Small Scale enterprise. The project consists of three modules. In the first module, demand forecast is performed with exponential smoothing method. Based on the current period demand, forecast is completed. The accuracy of forecasting is identified by the tracking Signal. Accordingly, smoothing constant is adjusted in exponential smoothing method to minimize the forecast error. This dynamic forecast method is suitable for the bakery products where demand fluctuations are more. From the demand forecast, aggregate demand is projected and aggregate production plan are evaluated to find the plan which will give the optimal cost. Aggregate planning methodology is included in the module two.

Keywords: Aggregate Planning, Exponential smoothing method, Tracking Signal.

I. INTRODUCTION

Forecasting is an activity to calculate or predict some future event or condition, usually as a result of rational study or analysis of opposite data. Forecasting is widely used today in many fields, particularly in industry, marketing, economic system and finance. Such as in expendable product manufacturing, an accurate prediction of the future demand is very helpful in providing exact inventory, reducing transportation costs, then increasing profit. Forecasting acts important role to predict future according to past data. Forecast methods may be broadly classified into qualitative and quantitative techniques. Qualitative methods are intuitive, largely educated guesses that may or may not depend on the past data. Quantitative methods use mathematical or statistical models to generate a reasonable prediction from the information of the past.

II. LITERATURE REVIEW

According to Amrit Pal Singh [1] the forecasting method will be selected on the basis of forecast error. Lesser the forecast error, the more accurate forecasting method and the specific purpose of this study was to identify the best quantitative forecasting method, based on level of accuracy and the ease of use in practice, to forecast demand of the Boot for Shoe Industry. James W. Taylor [2] Estimating the parameters of the exponential smoothing methods by minimizing the sum of absolute errors were preferable to minimizing the sum of squared errors. Mansoureh Farzam Rad [3] deals with aggregate production planning of the products in Hafez Tile factory during one year. In this factory, the manager seeks 3 goals in determining the optimal production rate. These goals are minimizing production cost, the maximum use of production capacity of factories and also providing the market 'demands. Nur Adilah Abd Jalil [4] investigated five exponential smoothing methods for forecasting the double seasonal (daily and weekly) electricity load demand. The best method found was the HWT exponential smoothing method based on the MAPE results. Sanjoy Kumar Paul [5] overcome the problems are raised to assign the value of exponential smoothing constant. In this paper, this problem is solved by determining the optimal value of exponential smoothing constant. Wan-I Lee [7] study proposes using Logistic Regression, Moving Average and Back-Propagation Neural Network methods for sales models designed to predict daily fresh food sales. Found that the correct percentage obtained by LR to be better than that obtained by the BPNN and MA models.

III. PROBLEM IDENTIFICATION

The data are collected from JAYAKA BAKERY. It is a small bakery shop in Durg Chhattisgarh especially famous for Bread, Toast, Cake, Snacks, Cream roll & cold drinks. They perform task in manually manner. Hence for each bakery shop it is necessary to maintain to smooth flow of production to full fill customer response. Also require the excess knowledge of production activity & capacity Planning. Sometimes

also suffer from uncontrollable production loss. & problem face that which plan is more suitable to achieve optimal value. hence to achieve these objectives Aggregate planning concept has used to achieve the objectives.

IV. METHODOLOGY

Exponential smoothing forecasting method

The new forecast for next period (period t) will be calculated as follows:

New forecast = Last period's forecast + α (Last period's actual demand – Last period's forecast)

$F_t = F_{t-1} + \alpha (D_{t-1} - F_{t-1})$

Where α is a smoothing coefficient whose value is between 0 and 1. The preferred range for α is from0.1 to 0.3.

Table 2 is showing Consumption Value of Items from September to October.

Aggregate planning

Aggregate planning concept used for capacity planning. Its include three plan-

1. Vary the manpower size.
2. Use over time and idle time.
3. Use inventory and stock out based on constant 11 workforces.

After applying all three plans select the most suitable plan according to optimum value. Here table 1is showing the cost structure related workers. And Table 3 is showing the Forecast Value of Items from September to October

Table 1 Different Cost Structure related Workers

S.NO	Particular	Value
1	No. of worker	11
2	labour cost	300Rs/day
3	Hiring cost	400Rs/day
4	Lay off cost	450Rs/day
5	Inventory cost	2Rs/Product
6	Overtime cost	30Rs/hr
7	Working hours	7Hrs/day
8	Idle time cost	20Rs/hr

Table 2 Consumption Value of Items from September to October

Date	Bread	Toast	Cake	Cream roll	Date	Bread	Toast	Cake	Cream roll
01/09/2015	94	109	49	45	**01/10/2015**	75	146	40	31
02/09/2015	81	124	49	41	**02/10/2015**	73	117	40	32
03/09/2015	96	122	42	33	**03/10/2015**	93	140	46	42
04/09/2015	98	132	31	34	**04/10/2015**	92	150	48	47
05/09/2015	100	140	35	47	**05/10/2015**	76	131	31	36
06/09/2015	109	150	45	50	**06/10/2015**	104	124	38	45
07/09/2015	73	114	36	39	**07/10/2015**	95	118	40	30
08/09/2015	79	134	30	32	**08/10/2015**	84	142	39	37
09/09/2015	107	133	31	49	**09/10/2015**	91	129	37	40
10/09/2015	76	108	33	43	**10/10/2015**	86	127	49	37
11/09/2015	103	106	43	39	**11/10/2015**	73	146	48	42
12/09/2015	92	145	45	48	**12/10/2015**	80	120	32	32
13/09/2015	110	150	43	39	**13/10/2015**	75	138	32	35

14/09/2015	73	117	32	31	**14/10/2015**	77	110	33	30
15/09/2015	88	129	41	30	**15/10/2015**	80	119	32	29
16/09/2015	74	111	36	35	**16/10/2015**	87	128	36	32
17/09/2015	90	130	35	39	**17/10/2015**	72	120	33	32
18/09/2015	70	113	34	31	**18/10/2015**	74	110	35	31
19/09/2015	101	140	44	45	**19/10/2015**	73	120	33	36
20/09/2015	103	145	45	45	**20/10/2015**	75	120	34	33
21/09/2015	75	130	37	33	**21/10/2015**	71	122	35	29
22/09/2015	73	148	43	32	**22/10/2015**	70	100	33	31
23/09/2015	86	127	46	42	**23/10/2015**	106	128	35	48
24/09/2015	71	120	32	30	**24/10/2015**	85	123	39	47
25/09/2015	102	107	49	48	**25/10/2015**	110	155	45	45
26/09/2015	87	140	46	45	**26/10/2015**	101	117	48	35
27/09/2015	106	142	50	45	**27/10/2015**	86	108	39	34
28/09/2015	77	130	32	30	**28/10/2015**	80	140	34	37
29/09/2015	81	141	39	38	**29/10/2015**	86	116	48	40
30/09/2015	76	112	36	36	**30/10/2015**	74	126	39	48
					31/10/2015	105	135	42	47

Table 3 Forecast Value of Items from September to October

Date	**Bread □ =.328**	**Toast □ =.3**	**Cake □ =.16**	**Cream roll □ =.3**	**Date**	**Bread □ =.328**	**Toast □ =.3**	**Cake □ =.16**	**Cream roll □ =.3**
01/09/2015	88	140	41	37	**01/10/2015**	82	128	40	38
02/09/2015	90	131	42	39	**02/10/2015**	80	133	40	36
03/09/2015	87	129	44	40	**03/10/2015**	78	128	40	35
04/09/2015	90	127	43	38	**04/10/2015**	83	132	41	37
05/09/2015	93	129	41	37	**05/10/2015**	86	137	42	40
06/09/2015	95	132	40	40	**06/10/2015**	83	135	40	39
07/09/2015	100	137	41	43	**07/10/2015**	90	132	40	41
08/09/2015	91	130	40	42	**08/10/2015**	91	128	40	37
09/09/2015	87	131	39	39	**09/10/2015**	89	132	40	37
10/09/2015	94	132	37	42	**10/10/2015**	90	131	39	38
11/09/2015	88	125	37	42	**11/10/2015**	88	130	41	38
12/09/2015	93	119	38	41	**12/10/2015**	83	135	42	39
13/09/2015	93	127	39	43	**13/10/2015**	82	130	40	37
14/09/2015	99	134	40	42	**14/10/2015**	80	133	39	36
15/09/2015	90	129	38	39	**15/10/2015**	80	126	38	34
16/09/2015	90	129	39	36	**16/10/2015**	80	124	37	33
17/09/2015	85	123	38	36	**17/10/2015**	82	125	37	33
18/09/2015	87	125	38	37	**18/10/2015**	79	124	36	32
19/09/2015	81	122	37	35	**19/10/2015**	78	119	36	32

20/09/2015	88	127	38	38	**20/10/2015**	77	120	40	33
21/09/2015	93	133	39	40	**21/10/2015**	76	120	39	33
22/09/2015	87	132	39	38	**22/10/2015**	74	120	38	32
23/09/2015	83	137	40	36	**23/10/2015**	73	115	37	32
24/09/2015	84	134	41	38	**24/10/2015**	82	118	37	37
25/09/2015	80	130	39	36	**25/10/2015**	89	120	37	40
26/09/2015	87	123	41	39	**26/10/2015**	94	128	39	41
27/09/2015	87	128	42	41	**27/10/2015**	96	126	41	39
28/09/2015	94	132	43	42	**28/10/2015**	93	121	40	38
29/09/2015	88	132	41	39	**29/10/2015**	90	126	39	38
30/09/2015	86	134	41	38	**30/10/2015**	89	123	41	38
					31/10/2015	85	124	40	41

Aggregating the demand from forecast obtain

Forecast is an estimate of an event which will happen in future. Demand forecast can be classified into long range, medium range and short range forecasts. The data has been collected for two month and according to the analysis of data it observed that this comes under medium range forecast. And aggregate planning uses medium range forecast. Aggregate planning is a process that follows capacity planning. The regular time production capacity may not be sufficient to cope with the demands of various products. Here table 4 is showing the specification of items.

Table 4 Specification of the Items

Demand	Date	Bread (400gm/unit)	Toast (200gm/unit)	Cake (200gm/unit)	Cream roll (50gm/unit)	Total
1st Fortnight	01/0915-15/09/15	1378	1956	609	608	4551
2nd Fortnight	16/09/15-30/09/15	1300	1946	602	577	4425
3rd Fortnight	1/10/15-15/10/15	1280	1977	613	568	4438
4th Fortnight	16/10/15-31/10/15	1331	1958	624	579	4492

Aggregate Plans

Three aggregate plans are proposed.

Plan1: Vary the workforce size to accommodate demand.

Plan2: Maintain a constant workforce of 11, and use over time and idle time to fulfill demand.

Plan3: Maintain constant workforce of 11, and build inventory or incur stock out cost.

All three plans has showed with the help of table from 5 to 4.19 where tables showed plan1, plan2, and plan3 respectively.

Table 5 Plan 1(Vary the workforce)

S.NO.	Particular	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
1	**Production required (unit)**	4551	4425	4438	4492	
2	**Production hrs required**	1517	1107	1110	1123	
3	**Hrs available per worker at 7hrs/day**	91	105	98	105	
4	**No. of Worker required**	13	11	12	11	

5	**No. of Worker hired**	2	-	1	-	
6	**Hiring cost (Rs.)**	800	-	400	-	1200
7	**worker laid off**	-	4	-	2	
8	**laid off cost(Rs.)**	-	1800	-	900	2700

Table 6 Plan 2(Use over time and idle time)

S.NO.	Particular	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
1	**Production required(unit)**	4551	4425	4438	4492	
2	**Production hrs required**	1517	1107	1110	1123	
3	**Hrs available per worker at 7hrs/day**	91	105	98	105	
4	**No. of hrs available**	1001	1155	1078	1155	
5	**No. of over time(Hrs)**	136	-	32	-	
6	**Over time premium(Rs.)**	4080	-	960	-	5040
7	**No. of idle time(Hrs)**	-	48	-	32	
8	**idle time cost (Rs.)**	-	960	-	640	1600

Table 7 Plan 3(Use inventory and stock out on constant 11 workforces)

S.NO.	Particular	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
1	**Production required(unit)**	4551	4425	4438	4492	
2	**Production hrs required**	1137	1107	1110	1123	
3	**Total hrs available**	1001	1155	1078	1155	
4	**Unit product**	4004	4620	4312	4620	
3	**cumulative Production**	4004	8624	12936	17556	
6	**Unit short**	547	-	126	-	
7	**Short cost(Rs.)**	3243.71	-	747.18	-	3990.89
8	**Excess unit**	-	195	-	128	
9	**Inventory cost(Rs.)**	-	390	-	256	646

V. RESULTS AND DISCUSSIONS

The cost for three plans
Plan1: 1,200 (hiring) + 2,700(Lay off) = 3900Rs.
Plan2: 5,040(Over time) + 1,600 (Idle time) = 6640Rs.
Plan3: 3,990.89(stock out) + 646(Inventory) = 4636.89Rs.
Hence Plan 1 is more economical.

VI. CONCLUSIONS

The selection of α value for exponential smoothing method plays a vital role for accurate demand forecast. The value of α is to be selected by tracking signal obtained. If the value of TS lies under the control limits, then the selected α value can be continued. But if the value of T.S. fall out of the control limit then it is required to change the value of α.

The selection of aggregate plan assists to performing of production activities for profit maximization. Generally we have three plans to perform the task. And aggregate planning help to selection of best plan to maintain success fully flow of production.

REFERENCES

[1] Amrit Pal Singh , Manoj Kumar Gaur, Dinesh Kumar Kasdekar and Sharad Agrawal, A Study of Time Series Model for Forecasting of Boot in Shoe Industry, *International Journal of Hybrid Information Technology Vol.8, No.8* (2015), pp.143-152

[2] James W. Taylor, *Exponential* Smoothing with a Damped Multiplicative Trend, *International Journal of Forecasting, Vol. 19*, (2003), pp. 715-725.

[3] Mansoureh Farzam Rad1, and Hadi Shirouyehzad, Proposing an Aggregate Production Planning Model by Goal Programming Approach, a Case Study, *Journal of Data Envelopment Analysis and Decision Science*, Year 2014 Article ID: dea-00061, 13 Pages

[4] Nur Adilah Abd Jalil, Maizah Hura Ahmad and Norizan Mohamed, Electricity Load Demand Forecasting Using Exponential Smoothing Methods, *World Applied Sciences Journal 22 (11):* 1540-1543, 2013

[5] Sanjoy Kumar Paul, Determination of Exponential Smoothing Constant to Minimize Mean Square Error and Mean Absolute Deviation, *Global Journal of Research in Engineering Volume 11 Issue 3* Version 1.0 April 2011

[6] Ukamaka Cynthia Orumie, and Daniel Ebong, A Glorious Literature on Linear Goal Programming Algorithms, *American Journal of Operations Research*, 2014, 4, 59-71.

[7] Wan-I Lee, Cheng-Wu Chen, Kung-Hsing Chen, Tsung-Hao Chen, and Chia-Chi Liu, A Comparative study on the forecast of fresh food sales using logistic regression ,moving average and bpnn method, *Journal of Marine Science and Technology*, *Vol. 20, No. 2*, pp. 142-152 (2012)

[8] Yasser A. Davizón, César Martínez-Olvera, Rogelio Soto3, Carlos Hinojosa and Piero Espino-Román, Optimal Control Approaches to the Aggregate Production Planning Problem, *Sustainability*, 2015.

