DEMAND FORECASTING OF A FRUIT JUICE MANUFACTURING COMPANY

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Abstract - The aim of most fruits juice companies is to develop an effective and efficient model that will provide forecast for optimum production quantity for the selected company. Fruits are highly perishable products; therefore it is highly important that they are well preserved to avoid losing its freshness. Due to this condition, it is a problem for the producers to know exactly the necessary quantity of fruits to order from the primary source of supply, not knowing the exact amount of fresh fruits to order makes it uneasy to meet up with demand for the company's product and also to create an opportunity for heavy losses due to the perish ability of the fruits ordered from the market. This study focuses on selecting the best forecasting model for a leading fruit juice company based on the sales record using an operational period data set of 48 weeks each obtained from a leading fruit juice company based in Ibadan, Nigeria. The four forecasting techniques used includes moving average model, exponential smoothing model, weighted moving average and linear regression model and the data obtained were analyzed accordingly. After applying the four forecasting models to analyze the weekly sales data of the chosen company, the results obtained were compared. The model with the best performance rating (i.e. the one with minimum mean absolute percentage error) was moving average model. It was considered as the most excellent forecasting model to minimize forecasting error. Since this particular industry's products are seasonal, any forecasting techniques applied must be analyzed up to the seasonal trending level for essential analysis and justification of its application.

Index Terms: Forecast, Sales, Mean Absolute Percentage Error, Model

1 INTRODUCTION

Forecasting is a systematic approach to estimation of future customer requirements using statistical and mathematical methods (Krajčovič, 2004). Forecasting is a base of every part of business plan, including of distribution and sales plan. In the field of logistics planning (sales-, production- and purchasing-planning) we have to process a detailed data, structured according to items, markets, time behavior, etc (Krajčovič, 2004). Forecasting is usable in every production enterprise independent of applied logistics concept. Forecasting methods are used in each of decoupling point positions except of "purchase and make to order" concept, because in this case exist only order-blocked inventories (Krajčovič, 2004). The need for planning, strategy and information is very imperative in decision making (Linda, 2010). In the time past little amounts of information usually has effect on the different steps of the production chain. For management to take every important decision planning on a daily basis is very important (Arwa et al, 2014). Planning in the form; how much has been demanded for? How many is to be produced? How is to be stored?(UNDP, 2009).

For every food based industry especially confectionaries, higher productivityis the ultimate goal in terms of reduction in production costs, greaterdemand of products and ability to remain competitive by reduction in thecost of their various products. To achieve these, the various production inputs must be provided in theright quantities and at the right qualities at the right time and at the lowestpossible cost (Olusakin, 2014). Therefore in consideration of all these factors forecasting is avery important tool.

Fruits are highly perishable products, therefore it is highly important that they are well preserved to avoid losing their freshness and at the same time keep their vitamin content (John, 2004). Due to this condition it is a problem for the producers to know exactly the necessary quantity of fruits to order from the primary source of supply which is the locals in the rural areas. Not knowing the exact amount of fresh fruits to order makes it uneasy to meet up with demand for the company's product and also to create an opportunity for heavy losses due to damage to the perishability of the fruits ordered from the locals. Therefore, the certainty of the actual demand quantity can be made available before production commences. Fruit juice companies determine the quantity to be produced based on their personal judgment on the amount of juice packs sold the previous day. For the production quantity to be as close as possible to the actual demand quantity, reliable forecasts needs to be made to ensure that the production quantity is as close as possible to the actual demand quantity.

Reliable forecasts will help in maximizing sales and minimizing wastages and losses (Adnan and Murad, 2011).

The aim of the study is to develop an effective and efficient model that will provide forecast for optimum production quantity for the selected fruit juice industry. This study will also demonstrate the use of the proposed model in the operations and sales services of the fruit juice industry.

2 MATERIALS AND METHODS

The sales data was collected from a Fruit Juice Company in Ibadan (capital city of Oyo state, Nigeria) using a combination of desk study, primary data collection through field visit. Primary data sources were explored to generate the information required for various aspects of the study. The company produces four different products namely; Orange juice, Pineapple juice, Oranpine juice (mixture of orange and pineapple) and Vogue cocktail juice. A total of forty eight (48) weeks sales data was collected for analysis. The table below shows the sales data for the company in year 2008.

TABLE 1: WEEKLY SALES DATA IN NAIRA GATHERED FOR THE BASELINE 2008

MONTH	WEEK 1	WEEK 2	WEEK 3	WEEK 4
January	2,122,065	1,414710	2,829,420	707,355
February	1,778,880	1,556,520	1,222,980	1,000,620
March	984,000	1,968,000	885,600	1,082,400
April	2,887,950	3,850,600	1,925,300	962,650
May	1,376.960	1.239,264	826,176	3,442,400
June	1,802,060	1,396,545	2,327,575	3,724,120
July	4,542,600	908,520	908,520	2,725,560
August	690,200	345,100	1,380,400	1,035,300
September	2,362,290	2,699,760	674,940	1,012,410
October	2,927,220	1,951,480	2,439,350	2,439,350
November	1,343,845	4,569,920	5,375,380	2,150,152
December	1643,280	2,464,920	3,286,560	821,640

Forecasting models will be developed and compared for each month while the model with the least error will be chosen for that particular month. Exponential smoothing (with α= 0.2, 0.4, 0.6, 0.8) and moving average (of 2-month, 3-month, 4-month and 5-month) and weighted average models were applied.

The best option in each model will be identified for each month of the year. The option with the least mean absolute percentage error(M.A.P.E) will be chosen and recommended as the best for each particular week of the month.

2.1 Lists of Relevant Equations Used in the Study

2.1.1 Weighted Moving Average Model

$$F_t = \frac{\sum_{i=1}^{n} WiAi}{\sum_{i=1}^{n} Wi} \quad (1)$$

$$\sum_{i=1}^{n} Wi = 1 \quad (2)$$

Subject to

W = weight of the forecast

A = actual demand at time t

Ft = forecasted demand at time t

2.1.2 Simple Exponential Smoothing Model

$$F_t = \alpha D_t + \alpha(1-\alpha)D_{t-1} + \alpha(1-\alpha)^2 D_{t-2} \quad (3)$$

$$F_t = \alpha D_t + (1-\alpha)F_{t-1} \quad (4)$$

Where

F_t = Forecasted demand/sales period t.

D_t = Actual sales at periods t.

F_{t-1} = Forecast sales at period t – 1

α = Exponential smoothing constant ($0 \leq \alpha \leq 1$)

Ifα= 0, then the smoothing reduces to a non sensical (meaningless or pointless) result i.e. New forecast = Original forecast

2.1.3 Simple Moving Average Model

$$F_{t+1} = \frac{1}{n}(D_t + D_{t-1} + ... + D_{t+1}.....n) \quad (5)$$

$$F_{t+1} = \frac{1}{n}\sum_{i=t+1-n}^{t} D_i \quad (6)$$

2.1.4 Linear Regression Model

The general regression model could be defined as follows:

$$Y_i = F(X, B) \quad (7)$$

Where X is a set of independent variables, B is a set of function parameters. Y is the dependent variable $F\ (X,\ B)$ may be polynomial of any other or exponential curve.

For a simple regression, the following general Mthdegree polynomial may be used.

$$Y_i = B_0 + b_i X_i + B_2 X_2^2 + ...bmX_i^m \quad (8)$$

Where Y_i = the forecast in period X = independent variable

bi = set of function parameters,

The associated error, ei is given as

$$ei\,(Y_i - \overline{Y_i}) \quad (9)$$

Where Yi = observed demand in period i.

$\overline{Y_i}$ = the corresponding estimated value. The sum of the square of errors is as given:

$$S.E. = \sum_{i=1}^{N} e^2 i = \sum_{i=1}^{N} \left(Y_i - \overline{Y_i} \right)^2 \quad (10)$$

Where N = number of data set for M = 1, first degree polynomial

$$\overline{Y_i} = b_0 + b_i X_1 \quad \text{(a linear function)}$$

$$bi = \frac{N\sum X_i Y_i - (\sum X_i)(\sum Y_i)}{N\sum X_i^2 - (\sum X_i)^2} \quad (11)$$

$$bo = \frac{\sum Y_i}{N} - \frac{bi\sum X_i}{N} \quad (12)$$

2.1.5 Forecasting Model

In this study, the forecasting model considered is mean absolute percentage error (MAPE) and is given as:

$$\frac{100}{n}\sum_{t=1}^{n}\left|\frac{D_t - F_t}{D_t}\right| \quad (13)$$

3 RESULTS AND DISCUSSION

TABLE 2: EXPONENTIAL SMOOTHING MODEL FOR WEEK 1

EXPONENTIAL SMOOTHING FOR WEEK 1						MAPE			
Month	Sales (₦)	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$	$\alpha = 0.8$	0.2	0.4	0.6	0.8
January	2122065								
February	1778880	2122065	2122065	2122065	2122065	19.2922	19.2922	19.2922	19.2922
March	984000	2053428	1984791	1916154	1847517	108.6817	101.7064	94.7311	87.75579
April	2887950	1839542	1584475	1356862	1156703	36.30283	45.13497	53.01644	59.94725
May	1376960	2049224	2105865	2275515	2541701	48.82233	52.9358	65.25641	84.58784
June	1862060	1914771	1814303	1736382	1609908	2.830797	2.564748	6.749414	13.54155
July	4542600	1904229	1833406	1811789	1811630	58.08064	59.63973	60.1156	60.1191
August	690200	2431903	2917083	3450275	3996406	252.3476	322.6432	399.895	479.0214
September	2362290	2083563	2026330	1794230	1351441	11.79904	14.22179	24.047	42.79106
October	2927220	2139308	2160714	2135066	2160120	26.91673	26.18546	27.06165	26.20574
November	1343845	2296890	2467316	2610358	2773800	70.9193	83.60127	94.2455	106.4077
December	1643280	2106281	2017928	1850450	1629836	28.17544	22.79878	12.60713	0.818119
					Sum	664.1686	750.7243	857.0175	980.4878
					Mean	**55.35**	62.56	71.42	81.71

TABLE 3: EXPONENTIAL SMOOTHING MODEL FOR WEEK 2

EXPONENTIAL SMOOTHING FOR WEEK 2						MAPE			
Month	Sales (₦)	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$	$\alpha = 0.8$	0.2	0.4	0.6	0.8
January	1414710								
February	1556520	1414710	1414710	1414710	1414710	9.110709	9.110709	9.110709	9.110709

March	1968000	1443072	1471434	1499796	1528158	26.67317	25.23201	23.79085	22.3497
April	3850600	1548058	1670060	1780718	1880032	59.79698	56.62857	53.75478	51.17562
May	1239264	2008566	2542276	3022647	3456486	62.07734	105.144	143.9067	178.9144
June	1396545	1854706	2021071	1952617	1682708	32.80672	44.71939	39.81772	20.49082
July	908520	1763074	1771261	1618974	1453778	94.05996	94.96112	78.19904	60.01604
August	345100	1592163	1426164	1192702	1017572	361.3627	313.2612	245.6104	194.8628
September	2699760	1342750	993738.7	684140.6	479594.3	50.26409	63.19159	74.65921	82.23567
October	1951480	1614152	1676147	1893512	2255727	17.28574	14.10892	2.970451	15.59057
November	4569073	1681618	1786280	1928293	2012329	63.19565	60.90497	57.79685	55.9576
December	2464920	2259109	2899397	3512761	4057724	8.349609	17.62643	42.51014	64.6189
					Sum	784.9827	804.889	772.1268	755.3229

TABLE 4: EXPONENTIAL SMOOTHING MODEL FOR WEEK 3

EXPONENTIAL SMOOTHING FOR WEEK 3						MAPE			
Month	*Sales (N)*	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$	$\alpha = 0.8$	0.2	0.4	0.6	0.8
January	2829420								
February	1222980	2829420	2829420	2829420	2829420	131.3546	131.3546	131.3546	131.3546
March	885600	2508132	2186844	1865556	1544268	183.2127	146.9336	110.6545	74.37534
April	1925300	2183626	1666346	1277582	1017334	13.41742	13.45004	33.64242	47.15974
May	826176	2131960	1769928	1666213	1743707	158.0516	114.2313	101.6777	111.0575
June	2327575	1870804	1392427	1162191	1009682	19.62435	40.17692	50.0686	56.62085
July	908520	1962158	1766486	1861421	2063996	115.973	94.43559	104.885	127.1823
August	1380400	1751430	1423300	1289681	1139615	26.87846	3.107777	6.57197	17.44311
September	674940	1677224	1406140	1344112	1332243	148.4998	108.3355	99.14544	97.38689
October	2439350	1476767	1113660	942608.9	806400.6	39.46062	54.34604	61.35819	66.94199
November	5375380	1669284	1643936	1840654	2112760	68.94575	69.41731	65.7577	60.69561
December	3286560	2410503	3136514	3961489	4722856	26.65574	4.565455	20.53604	43.70211
					Sum	932.074	780.3542	785.6521	833.92
					Mean	77.67	65.03	65.47	69.49

TABLE 5: EXPONENTIAL SMOOTHING MODEL FOR WEEK 4

EXPONENTIAL SMOOTHING FOR WEEK 4						MAPE			
Month	*Sales (N)*	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$	$\alpha = 0.8$	0.2	0.4	0.6	0.8
January	707355								
February	1000620	707355	707355	707355	707355	29.30833	29.30833	29.30833	29.30833
March	1082400	766008	824661	883314	941967	29.2306	23.81181	18.39302	12.97422
April	962650	829286.4	927756.6	1002766	1054313	13.8538	3.624723	4.167205	9.521986
May	3442400	855959.1	941714	978696.2	980982.7	75.13482	72.64368	71.56936	71.50294
June	3724120	1373247	1941988	2456918	2950117	63.12559	47.85376	34.02687	20.78353
July	2725560	1843422	2654841	3217239	3569319	32.36539	2.594659	18.03957	30.95728
August	1035300	2019849	2683129	2922232	2894312	95.09799	159.1644	182.2594	179.5626
September	1012410	1822940	2023997	1790073	1407102	80.05942	99.91873	76.81302	38.98543
October	2439350	1660834	1619362	1323475	1091348	31.91491	33.61501	45.74476	55.26069
November	2150152	1816537	1947357	1993000	2169750	15.51588	9.431641	7.308877	0.911456
December	821640	1883260	2028475	2087291	2154072	129.2074	146.8813	154.0396	162.1673
					Sum	594.8142	628.848	641.6701	611.9358
					Mean	49.57	52.4	53.47	50.99

TABLE 6: MOVINGAVERAGE MODEL FOR WEEK 1

MOVING AVERAGE FOR WEEK 1

MONTH	SALES (₦)	2month	MAPE	3month	MAPE	4month	MAPE	5month	MAPE
January	2122065								
February	1778880								
March	984000	1950473	98.21875						
April	2887950	1381440	52.16538	1628315	43.61693				
May	1376960	1935975	40.59777	1883610	36.79482	1943224	41.1242		
June	1862060	2132455	14.52128	1749637	6.037578	1756948	5.644958	1829971	1.723306
July	4542600	1619510	64.34839	2042323	55.04065	1777743	60.86509	1777970	60.86008
August	690200	3202330	363.9713	2593873	275.8147	2667393	286.4666	2330714	237.6868
September	2362290	2616400	10.75694	2364953	0.112744	2117955	10.34314	2271954	3.824086
October	2927220	1526245	47.86026	2531697	13.51191	2364288	19.23096	2166822	25.9768
November	1343845	2644755	96.80506	1993237	48.32341	2630578	95.75007	2476874	84.31248
December	1643280	2135533	29.95549	2211118	34.55518	1830889	11.41672	2373231	44.42037
		Sum	819.2006		513.808		530.8417		458.8039
		Mean	68.27		42.82		44.24		38.23

TABLE 7: MOVINGAVERAGE MODEL FOR WEEK 2

MOVING AVERAGE FOR WEEK 2

MONTH	SALES (N)	2month	MAPE	3month	MAPE	4month	MAPE	5month	MAPE
January	1414710								
February	1556520								
March	1968000	1485615	24.51143						
April	3850600	1762260	54.23415	1646410	57.24277				
May	1239264	2909300	134.7603	2458373	98.37366	2197458	77.31956		
June	1396545	2544932	82.23058	2352621	68.46012	2153596	54.20885	2005819	43.62722
July	908520	1317905	45.06059	2162136	137.9845	2113602	132.6423	2002186	120.3788
August	345100	1152533	233.9706	1181443	242.348	1848732	435.7091	1872586	442.6212
September	2699760	626810	76.78275	883388.3	67.27901	972357.3	63.98357	1548006	42.66136
October	1951480	1522430	21.98588	1317793	32.47211	1337481	31.46324	1317838	32.46983
November	4569073	2325620	49.10084	1665447	63.54957	1476215	67.69115	1460281	68.03988
December	2464920	3260277	32.26703	3073438	24.68712	2391353	2.984549	2094787	15.01604
		Sum	754.9042		792.3968		866.0024		764.8144
		Mean	62.91		66.03		72.17		63.73

TABLE 8: MOVINGAVERAGE MODEL FOR WEEK 3

MOVING AVERAGE FOR WEEK 3

MONTH	SALES (₦)	2month	MAPE	3month	MAPE	4month	MAPE	5month	MAPE
January	2829420								
February	1222980								
March	885600	2026200	128.794						
April	1925300	1054290	45.24022	1646000	14.50683				
May	826176	1405450	70.11508	1344627	62.75305	1715825	107.6827		
June	2327575	1375738	40.89393	1212359	47.91323	1215014	47.79915	1537895	33.92715
July	908520	1576876	73.5653	1693017	86.3489	1491163	64.13098	1437526	58.22725
August	1380400	1618048	17.21584	1354090	1.905945	1496893	8.439058	1374634	0.417691
September	674940	1144460	69.5647	1538832	127.9953	1360668	101.5983	1473594	118.3297
October	2439350	1027670	57.87115	987953.3	59.49932	1322859	45.77003	1223522	49.84229
November	5375380	1557145	71.03191	1498230	72.12792	1350803	74.87057	1546157	71.23632

December	3286560	3907365	18.8892	2829890	13.89508	2467518	24.92097	2155718	34.40807
		Sum	593.1814		486.9456		475.2118		366.3884
		Mean	49.43		40.58		39.6		30.53

TABLE 9: MOVINGAVERAGE MODEL FOR WEEK 4

MOVING AVERAGE FOR WEEK 3

MONTH	SALES (₦)	2month	MAPE	3month	MAPE	4month	MAPE	5month	MAPE
January	707355								
February	1000620								
March	1082400	853987.5	21.10241						
April	962650	1041510	8.19197	930125	3.378694				
May	3442400	1022525	70.29616	1015223	70.50827	938256.3	72.74412		
June	3724120	2202525	40.85784	1829150	50.8837	1622018	56.44562	1439085	61.35772
July	2725560	3583260	31.46876	2709723	0.581043	2302893	15.50755	2042438	25.06355
August	1035300	3224840	211.4885	3297360	218.4932	2713683	162.1156	2387426	130.6023
September	1012410	1880430	85.73799	2494993	146.441	2731845	169.8358	2378006	134.8857
October	2439350	1023855	58.02755	1591090	34.77402	2124348	12.91338	2387958	2.106791
November	2150152	1725880	19.73219	1495687	30.4381	1803155	16.13825	2187348	1.729924
December	821640	2294751	179.2891	1867304	127.2655	1659303	101.9501	1872554	127.9045
		Sum	726.1924		682.7635		607.6505		483.6505
		Mean	60.52		56.9		50.64		40.3

TABLE 10: WEIGHTED MOVINGAVERAGE MODEL FOR WEEK 1

WEIGHTED MOVING AVERAGE FOR WEEK 1

MONTH	WEIGHT(Wn)	ACTUAL SALES (N)	FORECAST	MAPE
January	0.22	2122065		
February	0.33	1778880		
March	0.44	984000		
April		2887950	1486845	48.51557
May		1376960	1986772	44.28681
June		1862060	1775366	4.655817
July		4542600	1909052	57.97446
August		690200	2916155	322.5087
September		2362290	2212399	6.345148
October		2927220	2266546	22.57003
November		1343845	2219377	65.15123
December		1643280	2076978	26.39223
			Sum	598.4
			Mean	49.87

TABLE 11: WEIGHTED MOVINGAVERAGE MODEL FOR WEEK 2

WEIGHTED MOVING AVERAGE FOR WEEK 2

MONTH	WEIGHT(Wn)	ACTUAL SALES (N)	FORECAST	MAPE
January	0.22	1414710		
February	0.33	1556520		
March	0.44	1968000		
April		3850600	1690807.8	56.08975744
May		1239264	2686138.4	116.7527177
June		1396545	2248934.16	61.03556706
July		908520	1870568.92	105.8918813
August		345100	1133246.73	228.3821298
September		2699760	758895.5	71.89026062
October		1951480	1501651.8	23.05061799
November		4569073	1825494	60.04673158
December		2464920	3248327.72	31.78227772
			Sum	754.9219413
			Mean	62.91

TABLE 12: WEIGHTED MOVINGAVERAGE MODEL FOR WEEK 3

WEIGHTED MOVING AVERAGE FOR WEEK 3				
MONTH	WEIGHT(Wn)	ACTUAL SALES (N)	FORECAST	MAPE
January	0.22	2829420		
February	0.33	1222980		
March	0.44	885600		
April		1925300	1415719.8	26.46757388
May		826176	1408435.6	70.47646022
June		2327575	1193698.44	48.71493121
July		908520	1720337.08	89.35599436
August		1380400	1349607.27	2.230710664
September		674940	1419254.1	110.2785581
October		2439350	952380	60.95763216
November		5375380	1599732.2	70.23964445
December		3286560	3318639.5	0.976081374
		Sum	479.6975864	
		Mean	39.97	

TABLE 13: WEIGHTED MOVINGAVERAGE MODEL FOR WEEK 4

WEIGHTED MOVING AVERAGE FOR WEEK 4				
MONTH	WEIGHT(Wn)	ACTUAL SALES (N)	FORECAST	MAPE
January	0.22	707355		
February	0.33	1000620		
March	0.44	1082400		
April		962650	962078.7	0.059347
May		3442400	1000894.4	70.92452
June		3724120	2070458.5	44.40409
July		2725560	2986387.8	9.569696
August		1035300	3185534	207.6919
September		1012410	2174273.2	114.7621
October		2439350	1386732.6	43.15155
November		2150152	1635175.3	23.95071
December		821640	1973782.58	140.2247
			Sum	654.7387
			Mean	54.56

TABLE 14: LINEAR REGRESSION MODEL FOR WEEK 1

LINEAR REGRESSION MODEL WEEK 1			
MONTH	SALES (N)	FORECAST	MAPE
January	2122065	1997051	5.89
February	1778880	2005486	12.74
March	984000	2013922	104.67
April	2887950	2022357	29.97
May	1376960	2030793	47.48
June	1862060	2039228	9.51
July	4542600	2047664	54.92
August	690200	2056099	197.90
September	2362290	2064535	12.60
October	2927220	2072970	29.18
November	1343845	2081406	54.88
December	1643280	2089841	27.17
		Sum	586.91
		Mean	48.9

TABLE 15: LINEAR REGRESSION MODEL FOR WEEK 2

LINEAR REGRESSION MODEL WEEK 2			
MONTH	SALES (N)	FORECAST	MAPE
January	1414710	1460664	3.25
February	1556520	1564247	0.50
March	1968000	1667831	15.25
April	3850600	1771415	54.0
May	1239264	1874998	51.3
June	1396545	1978582	41.68

July	908520	2082166	129.18
August	345100	2185749	533.37
September	2699760	2289333	15.20
October	1951480	2392917	22.62
November	4569073	2496500	45.36
December	2464920	2600084	5.48
		Sum	917.19
		Mean	76.43

TABLE 16: LINEAR REGRESSION MODEL FOR WEEK 3

LINEAR REGRESSION MODEL WEEK 3			
MONTH	SALES (N)	FORECAST	MAPE
January	2829420	1097846	61.20
February	1222980	1263120	3.28
March	885600	1428393	62.29
April	1925300	1593667	17.23
May	826176	1758940	112.9
June	2327575	1924214	17.33
July	908520	2089487	129.99
August	1380400	2254761	63.34
September	674940	2420034	258.56
October	2439350	2585308	5.98
November	5375380	2750581	48.83
December	3286560	2915855	11.28
		Sum	792.21
		Mean	66.02

TABLE 17: LINEAR REGRESSION MODEL FOR WEEK 4

LINEAR REGRESSION MODEL WEEK 4			
MONTH	SALES (N)	FORECAST	MAPE
January	707355	1506153	112.9
February	1000620	1552064	55.11
March	1082400	1597975	47.63
April	962650	1643886	70.77
May	3442400	1689796	50.91
June	3724120	1735707	53.39
July	2725560	1781618	34.63
August	1035300	1827529	76.52
September	1012410	1873440	85.05
October	2439350	1919351	21.32
November	2150152	1965262	8.60
December	821640	2011173	144.78
		Sum	761.61
		Mean	63.47

The four forecasting techniques i.e. linear regression, exponential smoothing, weighted moving average and moving average were compared for all the weeks in the given year. The mean absolute percentage error obtained from using the forecasting models are tabulated below. The model with the minimum performance criteria is picked as the most optimal forecasting technique for analysing sales data.

TABLE 18: COMPARISON OF OBTAINED RESULTS FOR THE FOUR MODELS

WEEK	LINEAR REGRESSION ANALYSIS MODEL (MAPE)	EXPONENTIAL SMOOTHING MODEL α = 0.2, 0.4, 0.6, 0.8 (MAPE)	MOVING AVERAGE MODEL (M = 2,3,4,5) (MAPE)	WEIGTHED MOVING AVERAGE MODEL (M= 3)(MAPE)
1	48.91	$55.35, \alpha = 0.2$	$38.23, m = 5$	49.87
2	76.43	$62.94, \alpha = 0.8$	$62.91, m = 2$	62.91
3	66.02	$65.03, \alpha = 0.4$	$30.53, m = 5$	39.97
4	63.47	$49.57, \alpha = 0.2$	$40.3, m = 5$	54.56

With the comparison results in table 18, the following relevant information could be reached; for week 1, the model that is most suitable and with the least value is moving average model. It has a mean absolute percentage error (MAPE) of 38.23. In week 2, weighted moving average & moving average models have the minimum values of mean absolute percentage error. For week 3, moving average model is chosen with M taken as 5. Finally, moving average model is the least in week 4 compare to the other three models. Due to the consistency of the moving average, the fruit juice industry will be advised to always use this model to minimize the forecasting error of their company.

4CONCLUSIONS

Forecasts need not be accurate since they provide a point to start planning. It is better that the best use of the available data is made according to the situational demands. What is important is the proper use of data that is available. Normally, the forecast should be put in a range rather than exact data. Range helps in many ways in terms of highest figure and lowest figure. Accordingly, a judicious planning can be made. This case study tries to highlight the important of selecting the most suitable and relevant forecasting models for the organizations' product in which the generated information from the selected forecasting models are later integrated into action-decision making processes in utilizing every advantageous chances available to the organization in consideration. In this particular case study, four forecasting models were considered for the analysis of data collected from a well-known fruit juices industry based in Ibadan, Nigeria. After applying the four forecasting models to analyse the weekly sales data of the chosen company, comparison of results were observed at the same time. The model with the best performance rating (i.e. the one with minimum mean absolute percentage error) was considered as the most excellent forecasting model to minimize forecasting error. The comparison tables for the examined forecasting model for the four weeks are as represented in table.

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