Factors effecting the fill rate for a beverage company

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INTRODUCTION

The fill rate is the fraction of customer demand that is met through immediate stock availability, without backorders or lost sales (Ref. Wikipedia). The fill rate differs from the cycle service level indicator. The fill rate has a considerable appeal to practitioners because it represents the fraction of the demand that is likely to be recovered or better serviced if the inventory performance was to be improved. The fill rate is measured empirically by averaging the number of correctly serviced requests over the total number of requests.

Fill rate and cycle service level are distinct

The cycle service level is often mistakenly confused with the fill rate, and vice-versa. Yet, the two indicators are numerically different. While the two indicators are quite correlated, it is possible to find real-world situations were a high cycle service level does not translate into a high fill rate, and the other way around. Such situations tend to arise more frequently when demand is sparse (as for spare parts for example) or when demand is erratic.

Determination of factor effecting the fill rate for a beverage company

An analysis was done on data obtained from one distributor to determine the factors effecting the fill rate for a beverage company.

Sales, Operation and Distribution Network:

A typical distribution chain at a beverage company is:

The customers of the Company are divided into different categories and different routes, and every salesman is assigned to one particular route, which is to be followed by him on a daily basis. A detailed and well organized distribution system contributes to the efficiency of the salesmen. It also contributes towards lower costs, higher sales and higher efficiency thereby leading to higher profits for the firm.

Distribution channel

The distributor divides the retailers according to the channel that has four categories:

- **END type 1:** This category of retailers has shops that sell eatables like snacks and these shops doesn't have any provision for seating the customers. In these shops the consumption of 200ml, 300ml and 500ml bottles of aerated or non-aerated soft drinks is high.
- **END type 2:** This category of retailers has restaurants, hotels and small snacks shop that provides seating to the customer. In this type of channel reusable glass bottled aerated drinks r preferred more than pet bottles.
- **Grocery outlets:** This category has grocery shops from where people take away most of the products of daily use in bulk. This channel category has maximum sale of pet bottles, as customer in this channel like to take away.
- **Convenience outlets:** This category comprises of convenience outlets that keep basic products of daily use. This channel shows higher sale of pet bottles and lower sales of reusable glass bottles.

Taking order:

Order taking is a process in which each retail outlet in different area is asked for its order for different product variants. The delivery waiting time of the order is of 1 day and it may get extended to day 2 if the agency is closed on the delivery date. The order is taken by outlets in two ways:

- **Tele-sale order:** In this order taking process the order is taken on phone by sales executive in bottling plant. This order gets updated and becomes due for delivery on the next working day of the respective agency.
- **Pre-sale order:** In this process of taking order the order is taken by the Market Developer in their respective market using their Blackberry phone allotted to them by the company for the same purpose.

Fill Rate and its Calculation

The measure of order delivered by the distributor to the retailer in terms of percentage is known as Fill Rate. Fill rate is affected by several factors as follows:

i) **Availability of stock**: Fill rate highly depends upon this factor as the ordered stock can only be delivered when it is available with the distributor. The executives taking pre-sales order make sure that only those variant order should be taken that are available in the agency but executives taking tele-sale order might not take order according to stock available with agency as the stock in agency keeps on changing constantly and tele-sale order is taken from manufacturing plant office. So this leads to affect the fill rate severely. It may also happen that if a delivery date is holiday then the order gets carried forward which would require more stock for delivery.

ii) **Vehicle availability**: Vehicle and driver availability also affects the fill rate. If a driver falls sick or is on leave or vehicle breaks down on the way and extra vehicles and drivers are already in the market for delivery, then the stock for a particular route cannot be performed.

iii) **Vehicle capacity**: Vehicle's capacity in the market is also responsible for improving the fill rate. The vehicles available with the examined beverage agency is as follows:

Table 1

Vehicle	Capacity	No. of Vehicle available
3 wheeler auto	40 case	6
5 wheeler auto	70 case	2
Tata ace	110 case	1
Pickup	130 case	2
Total Capacity	750 case	
Number of rounds expected by each vehicle	4	
Total capacity in ideal case	3000 case	

If any of the vehicles doesn't move to the market for delivery, then its delivery capacity affects the fill rate.

iv) **Extra order:** Extra order may occur due to simultaneous order by tele-order and pre-sale order for the same retail outlet which may effects the delivery to order ratio. Extra order may also occur due to fake orders by executives on retailer's names to sell the product directly on the spot on the next day

v) **Order denied by the customer:** Fill rate can also be affected if the order is denied by the customer due to any of the following reasons-

- If the retailer's shop is closed.
- Unavailability of appropriate amount of cash with the retailer for payment to the salesmen.
- Unavailability of required number of empty reusable glass bottles to be re-filled.
- If the shop owner is not present on the shop.

Therefore, these four reasons constitute major order rejection that may lead to affect the fill rate severely.

Calculation of fill rate:

The fill rate is calculated by formula:

$$\frac{Order\ delivered}{Total\ Order\ made} * 100\%$$

The fill rate for beverage agency has been calculated by using order and delivery data for 15 days. For all these 15 days' major reasons for shortage has been also identified by interviewing Sales Team Leader, Market Developers, Salesmen and other employees of the Distributor. Data for number of vehicles in the market and capacity of vehicles in the market was also found out by agency data and regression was done in SPSS to find out dependency of fill rate on number of vehicles in the market and carrying capacity of the vehicles. This regression was done to find out the

dependency of fill rate on both the factors because these two factors can be controlled by the agency by taking appropriate steps.

Data Collection and Interpretation

Data collected from Krishna distributors is as follows:

Table-2:

Date	Order	Delivery	Number of vehicles in the market	Delivery capacity of the day (Cases)	Major reasons for shortage in delivery
25-05-2014	2341	2015	9	2320	Order denied by customer
26-05-2014	2093	1637	8	2120	Order denied by customer
27-05-2014	2572	1296	7	1720	Vehicle shortage
28-05-2014	4670	3113	11	3000	Extra order
29-05-2014	3125	2565	11	3000	Unavailability of stock
30-05-2014	2951	2080	10	2480	Unavailability of stock
31-05-2014	2698	1711	7	2000	Vehicle shortage
01-06-2014	2297	0	0	0	Vehicle shortage
02-06-2014	1025	2022	9	2400	No reason
03-06-2014	2115	1610	7	2080	Vehicle shortage
04-06-2014	5292	4090	11	3000	Extra order
05-06-2014	1905	873	6	1800	Vehicle shortage
06-06-2014	3426	3252	11	3000	Order denied by customer
07-06-2014	2992	3051	11	3000	Unavailability of stock
08-06-2014	1181	894	9	2320	Order denied by customer

According to the above data the following interpretations were made:

Interpretation of variation of order and delivery:
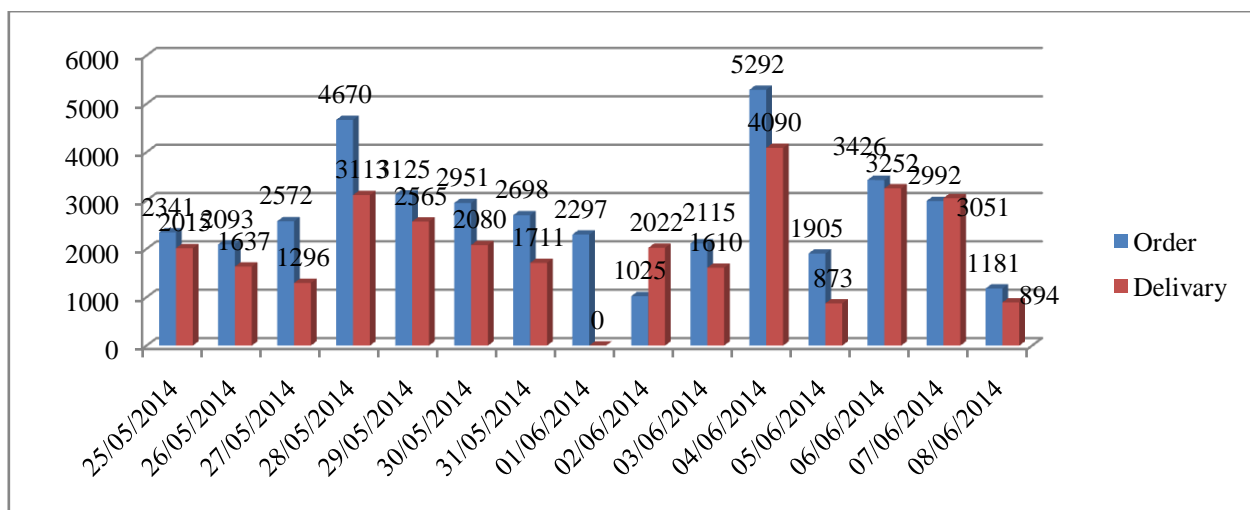
Figure 1: Graph showing order with delivery.

As we can observe from the above graph that on all of the days the deliveries are falling short of the orders, due to the reasons mentioned in the TABLE-2. We can also observe that on 2nd and 7th June 2014 the delivery exceeds the order, the reason behind this is, a day before 2nd June the day was Sunday when agency was closed and the order for 1st June was carried forward to 2nd June, so on 2nd June the delivery exceeds the order for the particular day. On 7th June the

delivery exceeds order by a minor margin and the probable reason behind this can be some stock that would have been delivered to a customer without order which happens in case of delivery to a customer for some personal function or extra delivery to sub-distributors.

According to the above data of TABLE-2 the fill rate for all 15 days have been found out.
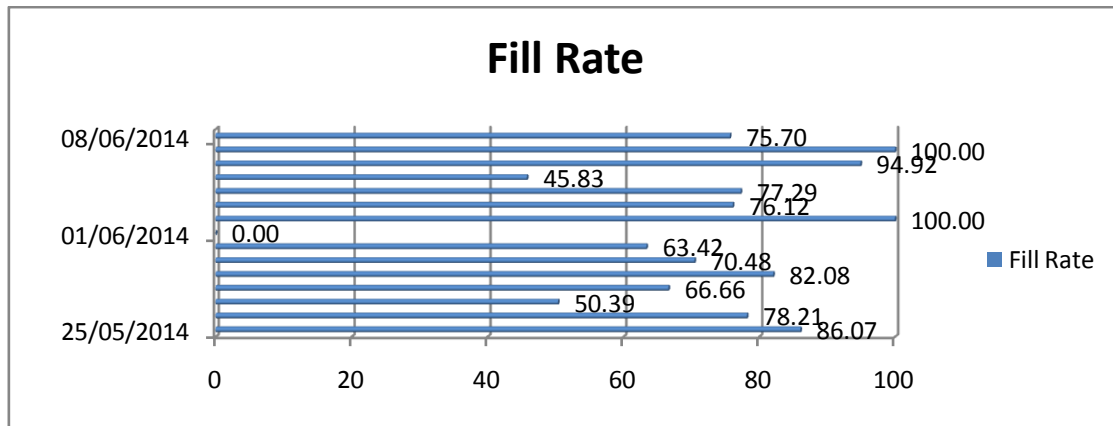

Figure 2: Graph showing variation of "Fill Rate" with time.

From the above graph we can observe "Fill Rate" for all 15 days observed. The average "Fill Rate" calculated from the data comes out to be 71.15%. The fill rate is always considered to be good if it is above 95% but for all these 15 days it's very short of 95 so the fill rate for these 15 days cannot be considered as satisfactory.

As we have discussed above in TABLE-1 about the number of vehicles available in the agency and its delivery capacity, the following graph shows the number of vehicles available in the market each day.
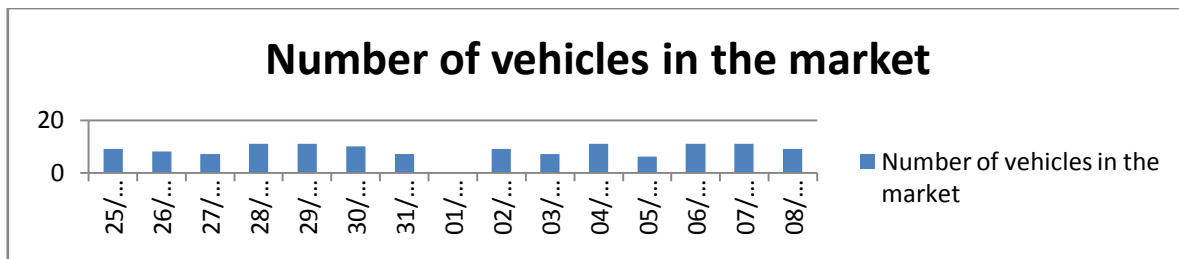

Figure 3: Graph showing variation of number of vehicles in the market with time.

According to the vehicles available in the market the delivery capacity for each day was calculated and also compared with the order and delivery for each day as follows:
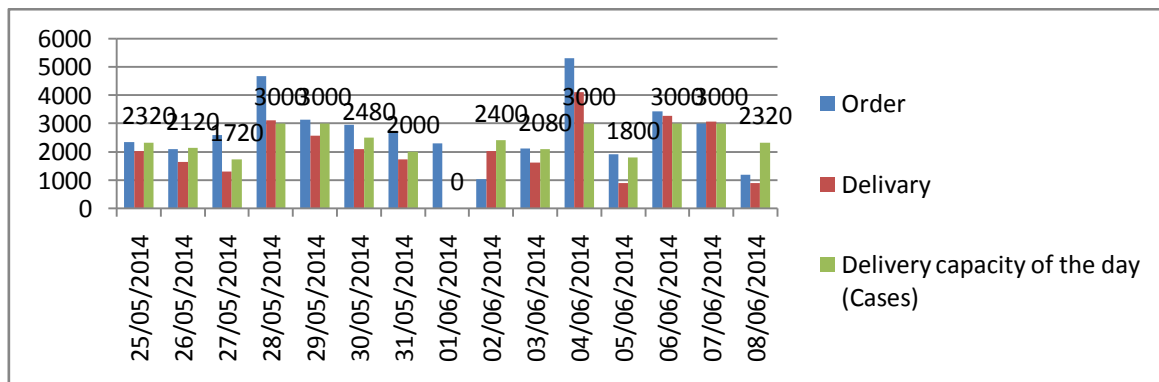

Figure 4: Graph showing variation of delivery capacity of vehicles in the market with order and delivery.

The above figure shows how delivery capacity for each day varies. From the above graph we can interpret how delivery capacity affects delivery and its probability of being the major reason behind the shortage of the delivery.
The major reasons identified by interviewing several employees can also be presented in the graphical form as follows:
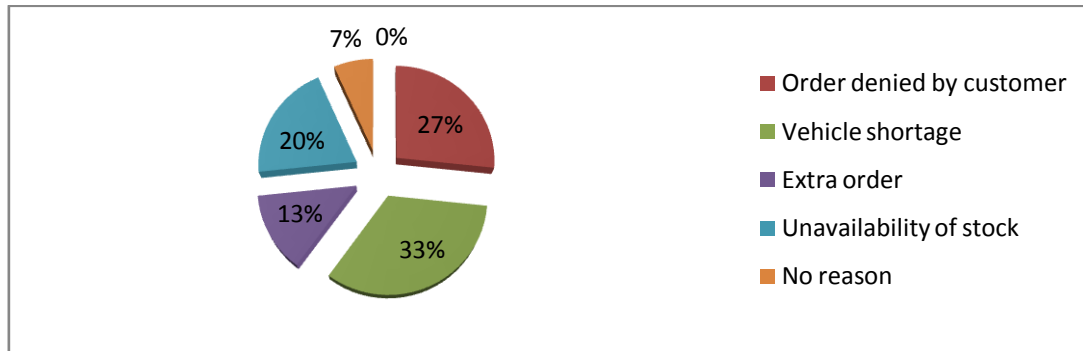
Figure 5: Pie chart depicting the major reasons responsible for low fill rate.

From the graph we can observe that the major reason behind the shortage in delivery of low fill rate is "Vehicle shortage" followed by "Order denied by the customer".

Regression analysis in SPSS

Observing "Vehicle shortage" as the major reason regression was done in SPSS to find out the relation between "Numbers of vehicles in the market". "Capacities of vehicles in the market" as independent variable and "Fill rate" as dependent variable.

The results found by SPSS analysis is as follows:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.861[a]	.741	.698	13.87941

a. **Predictors**: (Constant), Capacity_of_vehicle_in_the_market, Number_of_vehicles_in_the_market

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6608.239	2	3304.120	17.152	.000[a]
	Residual	2311.655	12	192.638		
	Total	8919.894	14			

a. Predictors:(Constant), Capacity_of_vehicle_in_the_market, Number_of_vehicles_in_the_market

b. Dependent Variable: Fill Rate

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.710	11.421		.675	.512
	Number_of_vehicles_in_the_market	2.959	8.621	.343	.343	.737
	Capacity_of_vehicles_in_the_market	.017	.032	.520	.521	.612

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.710	11.421		.675	.512
	Number_of_vehicles_in_the_ market	2.959	8.621	.343	.343	.737
	Capacity_of_vehicles_in_the _market	.017	.032	.520	.521	.612

a. Dependent Variable: Fill Rate

The first result from SPSS "Model Summary" shows value of "R square" to be 0.741 which says that dependent variable "Fill rate" depends on independent variables "Vehicles in the market" and "Capacity of vehicle in the market" by 74.1%.

The coefficient part of the result shows that beta for variables "Vehicles in the market" and "Capacity of vehicle in the market" comes out to be .343 and .520 respectively which shows for 1 unit change in "Vehicles in the market", "Fill rate" changes by .343 and same changes by .520 if change is 1 unit in variable "Capacity of vehicle in the market".
From the above data and interpretation, we conclude the following points:

i)   Fill rate for the data collection period is 71.14% which is not satisfactory since it is very short of 95 percent mark.
ii)   Among the major reasons of low fill rate, the "Vehicle shortage" occurs 33% of the time so it can be considered as one of the major reasons.
iii)   The capacity of vehicles in the market plays a very important role in improving the fill rate as we can see whenever the agency puts in its full delivery capacity in the market, the fill rate for the day often increases.
iv)   By SPSS analysis we can see that "Fill rate" depends on "Number of vehicles in the market" and "Capacity of vehicle in the market" by 74.1%. That itself says that these two variables are major reasons for the low fill rate but there are some other reasons also which constitutes for 25.9% of fill rate dependency.
v)   By SPSS we can also observe that the variation of "Fill rate" is higher for a unit change of "Capacity of vehicles in the market" than "Number of vehicles in the market".

RECOMMENDATIONS

From above conclusions we can recommend following points:

i)   The capacity of vehicles in the market should be increased either by bringing in new vehicles with larger capacity or increasing number of vehicles in the market to meet the required delivery capacity of the market.
ii)   Some drivers should be appointed and kept in reserve and all the drivers should be used on rotational basis so that there is less fatigue of drivers and no work is lost due to drivers going on leave.
iii)   Drivers should make a proper pre journey plan and follow it to avoid wastage of time in market due to unorganized routes of delivery.
iv)   A system should be made to avoid overlapping orders by tele-order and pre sales order.
v)   Tele-order executives should be aware of stocks and variants available with the distributor before taking order to avoid extra orders.

LIMITATIONS

i)   The research has been carried out for only one distributor so the conclusions and recommendations may vary for other agencies.
ii)   The research has been carried out on the basis of only 15 days' data so more verifications need to be done before making implications of the recommendations.