UNICEF RUTF CASE STUDY

Team 1 – Cohort C

ABSTRACT:

Spreadsheet modelling of RUTF demand and supply at Kenya.

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EXECUTIVE SUMMARY

Introduction:

There is a crisis in the Horn of Africa occurring due to shortage of food and thus resulting in malnourishment and famine in the countries including Kenya, Somalia, and Ethiopia. The objective is to reduce hunger among the people suffering by improving the supply chain of the RUTF being supplied to affected people. The focus is to improve the supply chain process and operations for RUTF being supplied to Kenya in order to maximize the demand fulfilled of RUTF required by the people by minimizing our cost involved.

Approach:

After evaluating the case we took into consideration the facts available in the case and some realistic calculated assumptions and estimations in order to derive the most appropriate model for the decision variable of the order point and the order quantity in order to achieve our objective of minimizing the cost.

Following are the inputs, assumptions, decision variables, and outputs taken into consideration for the analysis and model building

Assumptions & Rationale:

1. The model is made for the year of 2009.

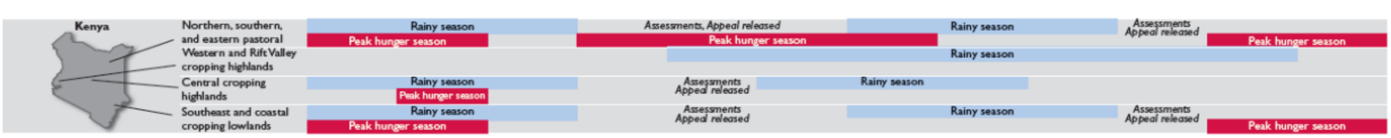
2. Initial Cash – An initial cash of $150000 has been assumed.

3. Budget – An annual budget of $ 900000 has been assumed

4. Demand - The demand for the years 2005 to 2008 is observed and an estimate for the year 2009 is taken. The data needed to calculate is taken from Exhibit 1 and Exhibit 9 of the case study. The demand for Kenya for 2008 is around 190 MT of RUTF. We expect a 35% growth in demand from the last year which comes out roughly around 260 MT of RUTF.

5. Weekly Demand - Weekly demand is uneven as Kenya is affected by seasonal droughts. The demand from January to May are at par with weekly average but the demand peaks in from October to November due to multiple regions suffering from peak hunger. We have calculated seasonal indexes based on these values and multiplied it by weekly mean demand. (Refer sheet Weekly Demand and Budget in excel).

The distribution of demand for a given week is assumed to be uniformly distributed. ie. If the given seasonality index for a month is 10%, we have uniformly distributed it from 8% to 12% using the RANDBETWEEN() of Excel.



6. Weekly Budget Allocation - Due to uneven distribution of demand across the months, we have allocated weekly budget accordingly.

7. Product Cost - The product cost is estimated from the given data to be $4,000/M.T.It has been assumed that the rising demand for RUTF will led to emergence of new manufacturers effectively leading to reduction of price per metric ton. Additional data referred through UNICEF website data. (http://www.unicef.org/supply/files/RUTF_Pricing_Data_final_July_2015.pdf)

8. Transportation Cost via Air - The cost of air transportation is mentioned in the case to be $2.4/kg. This input has been scaled up to metric ton.

9. Transportation Cost via Surface - The cost of surface transportation is mentioned in the case to be $0.17/kg. This input has been scaled up to metric ton.

10. Warehousing Cost - The warehousing cost is estimated to be $50/M.T. The warehousing cost is calculated on per inventory per week basis. Additionally, it has been assumed that emergency orders will also incur a warehousing cost as consignment will have to pass from warehouses to distribution centers.

11. Initial RUTF Inventory - The initial inventory at Nairobi warehouse is taken as 25 M.T.

12. Initial Pipeline Inventory - The initial pipeline inventory is estimated to be 20 MT arriving in week 3 and week 6 in equal splits.

13. Ordering Policy - We are assuming a periodically reviewed (s,S) policy in which the stocks are replenished to the level S if stocks dip below or equal s (reorder point). We are allowing a budget shortfall of $1000 which is being limited till 40th week to avoid negative balance at the end of year. We are not replenishing completely to the level of S if we have a limited budget and stocks reach the reorder point (i.e. we can order at partial levels. It has been assumed that there are no MOQs in the contracts). The inventory position is checked at the beginning of the week. We used the Risk Optimizer and calculated the optimum values to be (25, 56).

14. Lead Times - The lead time is triangularly distributed for the values 7, 8 and 9 weeks with 8 weeks being the most likely. This data is taken from the case study. However, this is different than the lead times mentioned in exhibit 8.

The model has been created in a way in order to take account into potential changes of inputs that may impact the overall decision variables of the reorder point and the reorder quantity. Following are some of the example of the changes in output due to the modification of inputs:

Inputs	Original Model	Fund disbursement changes (Initial - 600000, Budget - 450000)	Funding increase by 20%	Lead time Change (Risktriang (4,5,6))	Lead time Uncertainity Reduced (8 weeks fixed)	Demand Uncertainty Reduction	Surface Carrier Rate Reduction (by 20%)	Air Carrier Rate Reduction (by 20%)
Total Airfare	210396.94	140726.89	171794.80	100485.72	173295.31	173380.55	210347.56	173010.35
Total Warehouse Cost	25377.17	29515.51	31299.16	37810.60	26328.98	26394.69	25559.73	26352.21
Total RUTF Cost	826219.39	872364.16	1033346.84	912840.12	861029.89	861305.58	830635.21	862035.46
Total Surface Cost	20211.21	24615.28	28706.24	31677.97	21249.91	21254.08	16321.90	21317.88
Total Cost	1082204.70	1067221.84	1265147.04	1082814.40	1081904.10	1082334.90	1082864.40	1082715.90
No of weeks unsatisfied timely	14.51	6.94	0.01	5.27	12.13	12.49	14.23	12.36
Overall Demand Unsatisfied	6%	5%	0%	1%	4%	4%	6%	4%
No. of weekly budget shortfalls	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cost to Demand Satisfaction Ratio	2942.07	3470.35	4712.61	3803.42	3270.89	3230.72	2974.49	3243.19
Air Transport Fraction	35%	28%	29%	15%	35%	35%	35%	35%

Recommendations:

1. With increased initial fund disbursement, there is a significant drop in the number of weeks demand is unsatisfied timely. From our analysis, we could interpret that if we had an initial cash balance of more than 50% of the total cash balance then it provides the opportunity to allow for easier reordering and better planning rather than wait on periodic input of cash. The number of weeks where demand is unsatisfied timely drops from 14.51 to 6.94.

2. Increasing funding by 20% will allow to improve the functionality and flexibility in order to meet the best possible outcome for overall demand unsatisfied percentage to 0. However, increased funding leads to increased expenditure which results in higher Cost to Demand Satisfied Ratio.

3. If the lead time for surface orders is decreased to minimum, most likely and maximum with respective values of 4,5, and 6 weeks, it creates a significant impact by reducing the overall time needed for processing each order and fulfilling the demand for respective periods. The overall use of air transport is significantly reduced to only 15% and the faster processing of supplies reduced the overall demand unsatisfied to only 1%.

4. If the lead time uncertainty of surface order is reduced and fixed to only 8 weeks, it stills ends up providing a relatively same total cost and unsatisfied demand percentage. This provides the insight that the root cause of the inefficiencies or the non-optimization is primarily due to lack of funding but not poor planning.

5. Demand certainty reduction had a very less impact on our model. However, it should be noted that the demand distribution of our original model was not very wide. However, we would expect significant changes in the model if original distributions were rider.

6. The reduction of surface carrier rate and air carrier rate has resulted in reduced cost on the model. However, the costs are not decreasing much as lower transformational costs are allowing demands to be fulfilled which is limited my budgetary constraints.

Additionally parameters can be takes as Key Performance Indicators for this model to evaluate the effects different inputs have on the model.

<u>Lessons</u>:

1. It is very important thing to note that the output from the best plan for a particular set of inputs could change significantly when the inputs are changed (sometimes even slightly for some inputs). For eg. If the allocated budget is increased, the initial best inventory order policy could not even be a good policy for the new model. Low budgets usually have low reorder points and order levels. Using the same inventory policy leads to poor planning for newer budgets as it can lead to unnecessary expenditure on emergency orders which could have been avoided altogether.

2. Uncertainty among key parameters play a key role in the model outputs. Simulation models like this can be used to understand the significance of inputs on desired output variables (e.g. Cost, demand fulfillment rate, etc.). Then, further investment can be made to reduce uncertainty on significant inputs to optimize model parameters.