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Demand Forecasting for Medical and Logistical Supply in Humanitarian Relief Ongoing Operations
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Summary:
This thesis focus on the analysis of forecasting processes within a Non-Governmental Organization (NGO) that provides humanitarian relief on a global scale. The tools used to obtain forecast process information from its staff members were surveys and interviews. Forecast processes were analyzed, and recommendations were drawn in the form of pilots for testing alternative forecast methods.

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KEY INSIGHTS

1. Forecast process visibility through standard forecast formulation and reporting processes is pivotal for NGO's.

2. Group forecasting methods that allow the individual to integrate the maximum amount of his/her knowledge could improve resulting forecast accuracy.

3. To allow true item forecasts to drive operations it is important for staff to understand the difference between a forecast, a budget and a supply ordering tool.

Introduction

Demand planning is vital to this humanitarian relief organization's operations. The supply chain of a humanitarian relief organization differs from those of the private sector. The overall incentive for the organization is not profit maximization but the ability to provide timely service to the maximum number of people in need through the efficient use of resources. Supply and demand variability is usually high in this type of supply chain.

Because of the level of supply uncertainty within this supply chain the organization has to make sure that the few orders that can be received within a year match the quantities needed to provide services; therefore an accurate demand forecast is key to effectively match supply and demand.

The amount of historical data used and how expected future events are translated into expected changes in demand directly affect the forecasted amounts of product. The demand forecast process analysis in this thesis sheds light on how the organization currently integrates such elements into their medical and logistical item forecasts.

Currently this NGO has no good visibility of the detailed processes missions and projects follow to create a demand forecast. The main objective of this thesis is to increase the NGO's visibility of demand forecast processes and measure their current forecast accuracy, in order to provide this organization with a starting point to improve demand forecast activities. Given the current status of the organization's forecasting processes this thesis recommends pilot forecast techniques and processes that would be adequate to current operations. By benchmarking the forecast accuracy of pilot

processes to the forecast accuracy of current processes the NGO will be able to choose a demand forecast process that could improve their forecasting accuracy; and therefore improve overall supply/demand planning.

In order to draw demand forecast process flow charts, and gather detailed information about medical and logistical forecast formulation we used surveys and detailed interviews to the Medical (Medco) and Logistic (Logco) coordinators in the field. To get a notion about current demand forecast accuracy the NGO provided the following data by mission: 2011 SAP total purchase data by product accounts and 2011 budgets by product account. When possible 2011 item detail forecast data was gathered from the missions to compare to 2011 actual orders placed to the NGO's main warehouse. This data provided more additional insight on demand forecast accuracy.

Pilots with process improvement recommendations were driven by relevant literature found on demand forecast processes in the health industry and other industry sectors. Large groups with diverse members who have a varying knowledge level about processes can independently arrive to forecast point estimates that if averaged can potentially be quite accurate (Surowiecki 2005). This was taken into consideration to recommend pilot processes such that these would integrate the maximum level of knowledge into the forecasts.

Moreover the recommendation of use of A/F ratios was included in one of the pilots in order to measure if forecasters tend to over estimate or under estimate demand. Such ratios are used to adjust future forecasts according to expected tendencies and to create a probability distribution function of demand when no large amounts of demand data are available (Cachon 2008).

Demand Forecast Process Analysis for Medical and Logistical Product

12 out of 20 missions were surveyed about processes. All 12 responded with answers about their forecast processes. Four out of these 12 missions were interviewed on detailed forecast processes.

The primary questions on the survey were: 1) whether or not the medical and the logistic items

forecast was performed at the item level, 2) if these were performed at an item level, for what items type of items this forecast was performed, 3) whether or not they had data with the forecast formulation for the budget. The results are summarized in the following table:

Mission	Does your mission perform item level forecasts?		If it does, is it for ALL items?		Submited Files for 2011 itemized forecast?	Data Usable?
	Medco	Logco	Medco	Logco		
CAR	✔	✔	✔	✔	✔	✔
North Sudan	✔	✔	✔	✘	✘	✘
South Sudan	✔	✘	✔	✘	✘	✘
Zimbabwe	✔	✔	✔	✔	✘	✘
India	✔	✔	✘	✘	✔	✘
DRC	✔	✘	✘	✘	✘	✘
Colombia	✔	✔	✔	✔	✘	✘
Bolivia/Paraguay	✔	✔	✔	✔	✔	✘
Somalia	✔	✘	✔	✘	✘	✘
Ethiopia	✘	✘	✘	✘	✘	✘
Kenya	N/A	✔	N/A	✘	✘	✘
Nigeria	✔	✔	✔	✘	✘	✘
Yes	10	8	7	4	3	1
No	2	4	5	8	8	10
Total	12	12	12	12	12	12
Result	83%	67%	58%	33%	25%	8%

83% of the 12 missions perform an item detailed forecast for medical items versus 67% of them doing so for logistical items. It was not possible to obtain files with 2011 detail data in order to measure forecast accuracy. The main reason was the high staff turnover present in the field and the lack of structured reporting and forecast production process.

Through examples of 2012 files forecast production files (used for the annual budget) and the four mission's detailed interviews we found that there is no standard process for forecast calculation, but each Medco and Logco had formulated their own method to forecast for needs. The methods varied widely across projects. It was found that when calculating a forecast often Medco's and Logco's took into consideration current stock levels or safety stock levels needed; therefore difussing the line between forecast and a sort of order formulation process.

Forecast Accuracy

By comparing 2011 SAP total purchase data by product account and by project within a mission to the 2011 budget per product account per project it was apparent that missions tend to over budget for needs. From the total budget of 10.1 M Euros the missions used 6.1M Euros in actual purchases. 18 out of 22 projects over budgeted from 10% to 83%.

The only 2011 item detail forecast data that we could compare to 2011 total orders to the NGO's main warehouse was from the Central African Republic's (CAR) mission. This mission consisted of four projects Kabo, Batangfo, Ndele, and Gadzi. The results from the analysis are summarized in the following table:

CAR Mission-Kabo, Batangfo, Ndele, Gadzi
2011 Forecast Vs. Actual Expenses-Item Level

	SKU Qty	% of SKU's	Value		
SKU's Used and not Forecasted	172	25.63%	298,385	28%	% of Total Expenses
SKU's Forecasted but not Used	120	17.88%	207,563	15%	% of Total Budget
SKU's Forecasted and Used	378	56.33%	772,585	72%	% of Total Expenses

SKU's Forecasted and Used				
SKU Qty	Forecast Error%	Value	% of Total Expenses	
115	1-25%	299,803	28%	
70	26-50%	257,681	24%	
57	51-75%	89,074	8%	
40	76-99%	59586	6%	
96	100% +	66440	6%	

28% of the total medical expenses for the mission were for items that were not forecasted at all. 18% of the medical budget was for items that were forecasted and not used. As one can observe different quantities of medical items had different forecast error%. The results showed that the forecast error% was significantly higher for items that were for specific patient use than for items that were of more general use like gauze, glucose, and ibuprofen.

Recommendations

The first recommendation involves reporting of forecast data gathering in order to increase visibility by creating a standard excel files that Medco's and Logco's can use to create their forecasts. These files will include specific instructions on how to report forecasts amounts used for budget creation. Another recommendation involves the education of staff on the proper use of a forecast and the difference between a budget and an order calculation tool.

The two pilots with alternative forecast processes to test were the following:

Pilot 1

1)Separate total medical and logistical product by items for general patient use and specific patient use.

2)Perform different forecast calculation methods for each type. For general use items we would use monthly consumption averages and for specific patient use items we would use a group forecasting technique that involves individual forecast point estimation by the group and averaging of all point estimates to arrive to a forecast per item.

3) After gathering forecast accuracy data from the pilot forecasting method in step 2; we would be able to create A/F ratios to use in future adapt future forecasts and obtain a demand probability distribution function.

Pilot 2

1)As in pilot one medical and logistical items would be separated by general use and specific patient use.

2)General use items would be forecasted using monthly consumption averages.

3)Key staff at the headquarter, mission and project level would create a detailed list of items used per specific type or patient or case; these lists would represent a "recipe" for possible types of cases.

4)The same group of staff members involved in creating the point estimate forecast method in pilot 1 would be responsible for creating the same individual point estimate forecast but for the volume of different types of patients expected for the following year.

5)The forecast for patient cases from step 4 would be reconciled with items needed per case in step 3. The result would be an itemized annual forecast.

Both pilots would potentially maximize the level of knowledge integrated into the forecast by allowing each individual in a large group to think and calculate their own forecast according to experience. Moreover pilot 2 would provide an avenue to measure forecast accuracy for patient volumes and not for the items themselves thus facilitating the forecast process for staff and potentially reducing errors.

Conclusions

Forecast process visibility through standard forecast production and reporting is pivotal for this NGO. Through the implementation of the pilots in this thesis, this organization will have the opportunity to measure the impact that forecast alternate methods would have on forecast accuracy.

Sources Cited:

Surowiecki, James. "Wisdom of Crowds", Anchor Books, 2005.

Cachon, Gerard, and Terwiesch, Christian. "Matching Supply with Demand", McGraw-Hill/Irwin, 2008.