Supply Chain Analysis

Case Study 1: Merton's Trucks

1. a) Find the best product mix for Merton.

   Merton's best original product mix is 2000 Model 101s and 1000 Model 102s (see Excel sheet 1a_Answer Report).

   b) What would be the best product mix if engine assembly capacity were raised by one unit, from 4,000 to 4,001 machine-hours? What is the extra unit of capacity worth?

   By raising the engine assembly capacity by a single machine-hour, the product mix changes to 1999 Model 101s and 2001 Model 102s. We also gain an additional $2000 total contribution (one additional Model 102 is made, with one less Model 101 being: $5000-$3000=$2000 which agrees with the "Shadow Price" of additional engine assembly hours in 1b_Sensitivity Report. We see a confirmation of this in 1b_Answer Report.

   c) Assume that a second additional unit of engine assembly capacity is worth the same as the first. Verify that if the capacity were increased to 4,100 machine- hours, then the increase in contribution would be 100 times that in part (b).

   If the second additional unit of engine assembly capacity is worth the same as the first, and so forth, and if we increase total capacity to 4,100 machine-hours, then the increased contribution is indeed 100 times greater. This can be seen in 1c_Answer Report, which shows the total contribution to now be at $11.2Million. That is: $200,000/$2,000=100.

   d) How many units of engine assembly capacity can be added before there is a change in the value of an additional unit of capacity.

   By looking at 1a_Sensitivity Report, we can see that the allowable increase is 500 units (concurrent with the maximum machine-hours of 102 assembly). To go beyond that, the value of an additional unit would change and then we would need to run Solver again.

   By this analysis, if Merton Trucks were to invest in an additional capacity of 500 more machine hours of engine assembly, they could increase total contribution to 500*$2000=$1Million. This is confirmed in Excel on sheet 1d_Answer Report, which shows the Final Value increased to $12Million from the original $11Million. Increasing beyond that yields no increased contribution because the stamping capacity is now maxed out, creating a binding constraint.

2. Merton is considering the introduction of a new truck, to be called Model 103. Each Model 103 truck would give a contribution of $2,000. The total engine assembly capacity would be sufficient to produce 5,000 Model 103s per month, and the total metal stamping capacity would be sufficient to produce 4,000 Model 103s. The new truck would be assembled in the Model 101 assembly department, each Model 103 truck requiring only half as much time as a Model 101 truck.

Should Merton produce Model 103 trucks?

Given the current constraints, there is no good business case for why Merton should reallocate machine-hours to Model 103 production (see the Excel sheet 2a_Answer Report).

The reason is shown in 2_Sensitivity Report 2, Model 103 contribution must be greater than $2350 (current contribution of $2000 plus $350 allowable increase) before it becomes profitable to add it to production. At $2351 contribution for Model 103, it supersedes and replaces Model 101 production to product a total contribution of $11,002,857 ($2,857 higher than when producing Model 101, as shown in 2b_Answer Report).