Goal Programming Model Application for Optimization of Accessories Products of PT. Kosama Jaya Banguntapan Bantul by Tri Harjiyanto

Mathematical Model

a. Mazimize production to meet demands

a Variables and parameters used

The variables and parameters used in this goal programming formulation are as follows:
X_i : the ith number of product produced
i : type of product produced, $i = 1, 2, 3, 4$
P_i : level of demand for products i
d_i^- : value of deviation below
d_i^+ : value of deviation above
F_1 : pruduct sales revenue
F_2 : production costs incurred by the company
H_i : selling price per product ith unit
B_i : production costs per product unit i
W_{ij} : processing time per product unit i on the machine j
JE : capacity of regular machine j working hours
JL : capacity for overtime work

b Formulation of Constraints Function

(a) The target constraints maximizes the amount of production to meet the number of requests

$$X_i + d_i^- - d_i^+ = P_i \tag{1}$$

Where :
X_i = number of product i produced
P_i = level of demand for the product i
d_i^- value of deviation below of P_i
d_i^+ value of deviation above) of P_i

In order for minimum d_i^- and d_i^+, the equation of the objective function Z becomes:

$$MinZ = \sum(d_i^- - d_i^+) \tag{2}$$

(b) The target constraints maximize sales revenue
The equation of the objective function Z becomes :

$$Max\ Z = \sum_{i=1}^{m} H_i X_i \tag{3}$$

Where :
H_i = selling price per product unit i
X_i = number of product i produced
m = number of types of product

(c) The target constraints minimizez costs of production Objectiove function :

$$Min Z = \sum_{i=1}^{m} B_i X_i \tag{4}$$

Where : B_i =production costs per unit of product i

(d) Target Constraints to maximize machine working hours
Constraints :

$$\sum_{i=1}^{m} W_i X_i + d_i^- + d_i^+ = JE \tag{5}$$

Where :
W_{ij} = time of process per product unit i
JE =capacity of regular machine working hours
d_i^- value of deviation below of JR
d_i^+ value of deviation above of JR
Objecitive function Z becomes :

$$Min Z = \sum d_i^- \tag{6}$$

(e) The target constraints minimize overtime working
Target constraint :

$$d_i^+ \leq JL \tag{7}$$

Where :
JL =maximize capacity of overtime J machine
Objective function :

$$Min Z = \sum d_i^+ \tag{8}$$

c The use of model formulations is as follows:

(a) Minimize :
$Z = ((d_1^- + d_1^+) + (d_2^- + d_2^+) + (d_3^- + d_3^+) + (d_4^- + d_4^+) + (d_5^- + d_5^+) + (d_6^- + d_6^+) + (d_7^- + d_7^+))$

(b) The target constraint to maximize a mount of production to meet a mount of production

To find out the number of demands for type of product i, in this experiment the number of requests was predicted using the Arima method with sales data 12 months in 2013. The purpose of maximizing the amount of production to meet the number of requests has constraints written in the equation (1), which can be described as :

$$X_i + d_i^- - d_i^+ = P_i \tag{9}$$

$$X_1 + d_1^- + d_1^+ = 41890,87 \tag{10}$$

$$X_2 + d_2^- + d_2^+ = 33379,18 \tag{11}$$

$$X_3 + d_3^- + d_3^+ = 31558,68 \tag{12}$$

$$X_4 + d_4^- + d_4^+ = 34756,75 \tag{13}$$

The company wants to fulfill every demand for the product, so the objective function is to minimize the negative deviation number (d_i^-) which can be shown as follows:

$$MinZ = \sum d_i^- + d_i^+ \tag{14}$$

$$MinZ = d_1^- + d_2^- + d_3^- + d_4^- + d_1^+ + d_2^+ + d_3^+ + d_4^+ \tag{15}$$

(c) The target constraint to maximize sales revenue

The company wants to get maximum sales revenue. Equation (2) becomes:

$$\text{Max } Z = 12450X_1 + 10800X_2 + 15200X_3 + 7400X_4 \tag{16}$$

$$12450X_1 + 10800X_2 + 15200X_3 + 7400X_4 + d_5^- = F_1 \tag{17}$$

$$\text{Min } Z = d_5^- \tag{18}$$

(d) Target constraint minimizes production cost

The company wants to minimize total production cost to get maximum profit, so equation (4) becomes:

$$\text{Min } Z = 5590X_1 + 4481X_2 + 7245X_3 + 1365X_4 \tag{19}$$

$$5590X_1 + 4481X_2 + 7245X_3 + 1365X_4 + d_6^- = F_2 \tag{20}$$

$$\text{Min } Z = d_6^- \tag{21}$$

(e) Target constraint to maximize machine working hours
The company wants to maximize the use of machine, so the objective function is to minimize d_i^- as we see in equation (5), and it becomes:

$$W_1X_1 + W_2X_2 + W_3X_3 + W_4X_4 + d_7^- - d_7^+ = JE \tag{22}$$

$$7,452X_1 + 8,273X_2 + 4,002X_3 + 4,5206X_4 + d_7^- - d_7^+ = 344480 \tag{23}$$

$$\text{Min } Z = d_7^- \tag{24}$$

(f) The target constraints minimize overtime working
Because d_i^+, as in the equation (22), is the deviation value above regular working time, so the value of d_i^+ must be controlled and must not exceed maximum working time:

$$d_j^+ \leqslant JL \tag{25}$$

$$d_7^+ \leqslant 1347840 \tag{26}$$

So the objectiove function is to minimize d_i^+ as showed in equation (26)

$$\text{Min } Z = d_7^+ \tag{27}$$

d Results and Discussion

The results of this study are in the form of recommendations or input the optimal number of products that should be produced by the company to obtain effective and efficient production. Completion of the problems formulated in the form of this equation was carried out with the help of the LINGGO 13.0 computer program. In this study, researchers using the LINGO program to find information needed include:

(a) Information on optimal solution solutions (objective function value, decision variable value, devisional variable value, reduced cost value) and *slack*, *surplus* and *dual price values.*

(b) Information about sensitivity analysis to the value of the right segment of the equation model.