



Assignment No 14

Optimal Investment in Machines Maintenance

1. Assignment Description

Product machines age during the production process. The aging of machines result in decreasing production capacity and increase in the number of defected products. The firm may overcome the aging process through one of the following methods:

- Quarterly investments in return capital in order to maintain the quality of the machines
- Replacement of machines every several quarters

This assignment's aim is to compare the two policies.

2. Background Theory

Production capacity of a machine is given by the following equation:

$$Q = Q_{\max} - \alpha \frac{V}{V_{\max}}$$

Q – Production capacity

Q_{\max} – Production when the machine was new

V – Value of the machine

V_{\max} – Value of a new machine

α – Depreciation factor

The target function is the maximum value of production given investment in machine maintenance.

$$\sum_{t=1}^8 Q(t, V_t) * P_t - C_t$$

Where P_t is a vector of product prices that should be predicted and C is the investment in machine quality.



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3. Data Source

- Build a single firm with average technology
- Build a production plan for 30,000 units
- Estimate the depreciation rate of technology (α)
- Set a quarterly policy for investment in the machines maintenances
- Run simulations for eight quarters
- Set policy for machine replacement to once a year
- Run simulations for eight quarters

4. Analysis Required

1. Which of the policies provide better results?
2. How does the production capacity (i.e. the amount that is produced each quarter) influence the results?
3. Does the hourly rate of QA staff affect the results? If yes, how?