CAPSTONE RESEARCH

Pricing decision : new and remanufactured product in a closed-loop supply chain with separate sales-channel (2016)

Authors : Shu-San Gan, I. Nyoman Pujawan, Suparno, and Basuki Widodo.

POSTGRADUATE PROGRAM
INDUSTRIAL & SYSTEMS ENGINEERING DEPARTMENT
SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY

1. Background

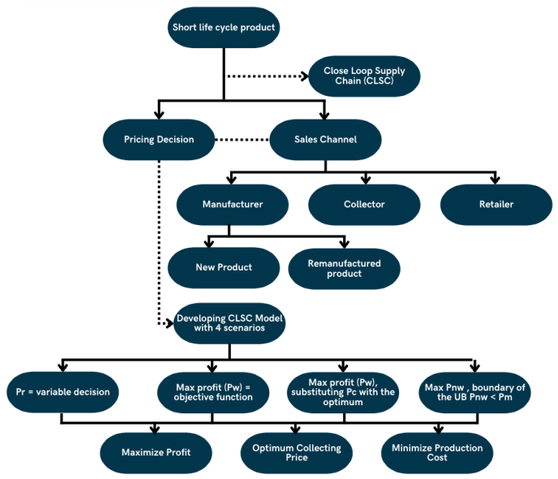
Increasing trend in selling products through non-traditional channels using manufacturer's direct channel or an e-channel ***encourage pricing decision*** model to develop for short life-cycle products in CLSC that consists of the manufacturer, retailer, and collector.

These pricing and channeling issues in the remanufacturing context are interdependent because the product price decision is affected by the sales channel used.

2. Objectives

Currently, ***there is no study addresses pricing strategy*** for both new and reman products that use separate sales channels in an integrated CLSC. Most of the papers that develop it ***consider only optimal prices*** and ***overlook the pricing decision*** in the core collection. In this paper, ***all three prices are optimized*** under a manufacturer Stackelberg.

3. Framework



4. Models

1. Developing CLSC of short life cycle products for both new and reman products using seperate channels.
2. The direct channel is a means of separating the market segments.
3. Demand for new products in CLSC model

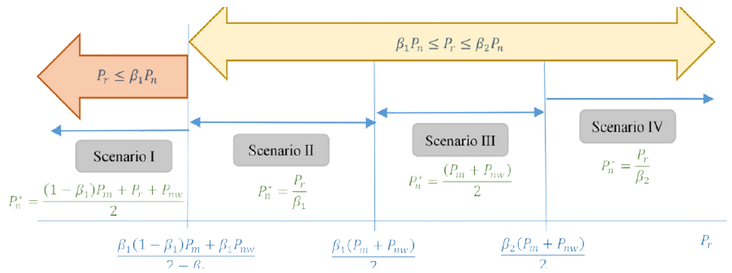
$$D_n = \begin{cases} \frac{d_{12}}{P_m}\left[P_m - \frac{P_n - P_r}{1-\beta_1}\right]; & P_r \le \beta_1 P_n \\ \frac{d_{12}}{P_m}[P_m - P_n]; & \beta_1 P_n \le P_r \le \beta_2 P_n \\ 0; & P_r \ge \beta_2 P_n \end{cases}$$

Demand for reman products in CLSC model

$$D_r = \begin{cases} \frac{1}{P_m}\left[d_{34}(P_m - \frac{P_r}{\beta_2}) + d_{12}\left(\frac{P_n - P_r}{1-\beta_1} - \frac{P_r}{\beta_1}\right)\right]; & P_r \le \beta_1 P_n \\ \frac{d_{34}}{P_m}\left[P_m - \frac{P_r}{\beta_2}\right]; & \beta_1 P_n \le P_r \le \beta_2 P_n \\ 0; & P_r \ge \beta_2 P_n \end{cases}$$

4. There are 4 scenarios to optimize under this model which are:
   - scenario 1 : reman price (Pr) is variable decision
   - scenario 2 : maximize profit (Pw) is the objective function
   - scenario 3 : maximize profit (Pw), substituting Pc with the optimum
   - scenario 4 : maximize Pnw with boundary of the upper bound Pnw < Pm

5. Model Optimization



After determining the optimal retail price based on two different intervals of reman price in the demand function, a restriction on the reman price is found based on the manufacturer's initial released wholesale price and the customer's maximum willingness to pay.

6. Results

1. The separate sales channel results in higher total supply-chain profit compared to the single-channel approach.
2. The best scenario for the supply chain overall is not necessarily the best for each individual member
   a. Scenario I provides the collector with the best result.
   b. Scenario II is implemented when the reman price lies at the borderline of switching from new to reman
   c. Scenario III is only applied when reman price falls within a certain interval between high-end customers' valuation of reman products and low end customers' willingness to pay.
   d. - Scenario IV works best for the retailer because it is implemented in a situation in which reman-acceptance is low
3. The reman-acceptance factor significantly influences both pricing decisions and the supply-chain members' profits.
4. The lower the reman-acceptance, the higher the retail price; thus, new-product demand decreases and the manufacturer's profit decreases

7. Future research

Pricing decision for new and remanufactured product in a closed-loop with environmental aspects, stochastic inventory and stochastic market demand

Created by : Suci Wulandari, Gloria Siahaan, Zelania Haryanto & Nur Ardiansah
Magister Student - ITS