Study on Existing Models with Reverse Logistics

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Abstract – Reverse logistics is the element of the branch network where the management with competence and competence organizes, executes and controls the flow of materials, the processing of stocks and related data from the brand of use to the starting point, in order to regain his esteem. Reverse Logistics aims at all activities related to the reuse of products and materials. Reverse logistics is the exchange of products that begins in one place and continues safely in the next. Reverse logistics not only integrates the flow of materials from supplier to consumer, but also the material path of the products used by the consumer to the producer and supplier to reduce the impact on the climate. The model is a collection of intelligent mathematical connections that represent significant variables, include a real-world function that evaluates the voting array, and constrains responses to achievable qualities. Task seeking is the specialty of winning a conflict without fighting, or we can say that OR as a dynamic device is both a science and a skill. On the other hand, the models are designed to "improve" some objective measures.

Keywords – Inventory, Models, Retro, Logistics

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INTRODUCTION

Restoration is an important issue for manufacturers / suppliers due to management assumptions about recycling and end customers. In today's reality, where reuse is considered harmless to the ecosystem, the flow of goods and materials has changed in recent years. The reverse inventory network has continued to evolve not only for the associated financial benefits, but also for the ecological interest. However, due to the rapid improvement of innovation and the imminent arrival of new modern products, the number of unused products has increased. Therefore, there has been a huge development of ecological problems around the world. Due to government regulations and consumer concerns about these environmental issues, more and more organizations are trying to reduce the amount of waste. The escalation of ecological problems means that organizations are at greater risk of conservation. Therefore, in the past few decades there has been a lot of interest in reverse product development from consumers to upstream organizations. In recent years, analysts have been thinking a lot about reverse logistics inventory models. Various research and reviews on reverse logistics have been conducted. In addition, the use of the economic order quantity (EOQ) technique is a method used by many designers to study depreciation frames. EOQ models are simple and mainly lead to closed structural arrangements. The main inverse model calculated was studied by Schrady. You have broken down the problem into the repairable object EOQ model, which provides instant build and repair rates with no disposal costs. Nahmias and Rivera considered the Schrady model for the case of a limited repair rate and limited inventory in maintenance and engineering shops. Fleischman et al. provide an impressive review of quantitative models for organizing recreation creation and inventory control. They examine the impact of subsequent attempts at reuse".

About Mabini et al. marketed reverse logistics models similar to EOQ, there is speculation in all products. They extended Schrady's core model to include an investment plan constraint. Richter explored a modified variant of Schrady's model, accepting several creations and several corrective cycles within a period of time. The vast majority of the models studied previously are represented by two-bound methods (bang-bang), or at least "fix all" or "reset all". In comparative work with Richter, Teunter favored a choice deterministic EOQ inventory model, in which things that can be saved and manufactured have different transportation costs, and like Richter, he adopted a holistic view. Ko et al. summarized the Nahmias and Rivera model by predicting a fixed constrained capacity.

Modeling in Operations Research:

The model is a set of logical and mathematical relationships that describe important variables, including an objective function that evaluates an alternative solution and constrains the solutions to acceptable values. Operations research is the art of winning war without fighting, or we can say that RO as a decision support tool is both a science and an art. OR models are designed to "optimize" a specific objective criterion.

In OR we don't have a general technique for solving all mathematical models. The main OR technique is linear programming, integral programming, dynamic programming, network programming, non-linear programming, etc. The main stages of the practical implementation of OR include:

1. Definition of the problem.
2. Construction of the model.
3. Model resolution.
4. Model validation.
5. Implementation of the model.

Preliminary considerations on existing models

“Reverse logistics is the part of supply chain management where we plan, implement and control the efficient and profitable flow of materials, inventory levels and related information from point of consumption to point of origin in order to evaluate recycling. Reverse logistics covers all operations related to the reuse of products and materials. Reverse logistics is the safe transport of products from one place to another. Reverse logistics includes not only the flow of materials from the supplier to the consumer, but also the flow of the used materials of the product from the consumer to the producer and supplier to reduce the environmental impact. This is the process of restoring the useful life of used items. Schrady (1967) was the first researcher to propose an integrated inventory model with an infinitely coordinated back and forth logistics system. Examples of reverse logistics include recalls, advertisements, returns, warranties, incorrect deliveries, repairs, and refurbishments. Reverse logistics is the process by which used products are collected and reconditioned to "like new" quality standards. Reverse logistics as an activity of planning, implementation and control of the process to obtain efficiencies and related to the flow of materials, supplies, finished products and information on consumers to production with the aim of restoring the economic value of the product. Reverse logistics, i.e. the management or return flow for the recovery of products, merchandise, returns or surplus stock, forms a closed supply chain. The success of the closed supply chain depends on the actions of producers and customers. For manufacturing, RL is the process of returning defective products by users. RL is an increasingly discussed topic both in the context of supply chain management”.

Demand: The demand for a product in stock is the number of units that must be taken out of stock for a specific use during a given period of time.

“Lead time: The time it takes a supplier to deliver products once an order has been placed and the replenishment lead time, which is the time before a new order opportunity arises. The delivery time is usually calculated in days. The production quantity economic model (also known as the EPQ model) determines how much a business or retailer should order to minimize total inventory costs by balancing inventory transport costs and fixed average ordering costs. The EPQ model was developed by EW Taft in 1918”.

Economic Order Quantity: (EOQ) is the ideal order quantity a company should purchase for its inventory, given a specified production cost, specified demand rate, and other variables. This is done to minimize storage costs and ordering costs.

Order cost: associated with ordering raw materials for production / finished products for storage in the inventory system. This includes advertising costs, stationery costs, postage costs, telephone costs, telegrams, transport costs, etc.

This is the additional cost of holding and maintaining an inventory over the course of a year.

Purchase Cost: This is the cost price that the supplier charges the reseller for one unit of the item. It plays an important role when there is a discount on the purchase price to be paid per unit when purchasing certain units.

costs : incurred when an item is out of stock; Also called exhaustion costs. Furthermore, the reduced costs (in the second case) can be calculated as sales plus customer goodwill or lost contribution margin.

Command cycle - The period of time between two consecutive commands is called the command cycle.

LEARNING OBJECTIVES

1. To study modelling in operations research:
2. Examine Crisp's Reverse Logistics Inventory Model

Heat up

“In this part we describe all applicable meanings of the fuzzy set hypothesis for the further development of the proposed model”.

Definition 1. A blurry whole $\tilde{A}$ in the universe of discourse X can be defined as

$$\tilde{A} = \{(x, \mu_{\tilde{A}}(x)) : x \in X\},$$

or $\mu_{\tilde{A}}(x)$ is the membership function that assigns each element a real value in the interval [0, 1].

"Definition 2 A fuzzy set $\tilde{A}$ in R (real line) is called a fuzzy number if it satisfies the following conditions".

(i) $\tilde{A}$ is normal, that is, it exists $x_0 \in R$ such that $\mu_{\tilde{A}}(x_0) = 1$.

(ii) $\tilde{A}$ is diffuse convex, that is

$$\mu_{\tilde{A}}(\lambda x_1 + (1-\lambda x_2)) \geq \min(\mu_{\tilde{A}}(x_1), \mu_{\tilde{A}}(x_2)) \text{ for every } x_1, x_2 \in R, \lambda \in [0,1]$$

(iii) The bearer $S(\tilde{A}) = \{x \in X : \mu_{\tilde{A}}(x) > 0\}$ of $\tilde{A}$ is limited.

"Let also be Ω the family of all fuzzy numbers. A fuzzy number $\tilde{A}$ is called a triangular fuzzy number (TFN) if its membership function $\mu_{\tilde{A}}$ is one"

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-a}{b-a}, & \text{if } a \leq x < b, \\ 1, & \text{if } x = b, \\ \frac{c-x}{c-b}, & \text{if } b < x \leq c, \\ 0, & \text{otherwise,} \end{cases}$$

where $a < b < c$. we denote TFN as $\tilde{A} = (a, b, c)$.

Definition 3 A blurry whole $\tilde{c}_\alpha$ or $0 \leq \alpha \leq 1$ it is called a fuzzy point of level α in c if its membership function is in R.

$$\mu_{\tilde{c}_\alpha}(x) = \begin{cases} \alpha, & x = c, \\ 0, & x \neq c. \end{cases}$$

Definition 4 A fuzzy set $0 \leq \alpha \leq 1$, where $\tilde{I}_\alpha[a, b]$,y is defined on R, is called a fuzzy interval of level α if its membership function is

$$\mu_{\tilde{I}_\alpha[a,b]}(x) = \begin{cases} \alpha, & a \leq x \leq b, \\ 0, & \text{otherwise.} \end{cases}$$

Consider the $\tilde{A} = (a, b, c)$. **TFN** with α cut $A_\alpha = [A_L(\alpha), A_U(\alpha)], 0 \leq \alpha \leq 1$ or $A_L(\alpha) =$ $a + (b-a)\alpha$ And $A_U(\alpha) = c - (c-b)\alpha$. Then the distance marked by $\tilde{A}$ measured by ˜01 is defined as

$$d(\tilde{A}, \tilde{0}_1) = \frac{1}{2}\int_0^1 [A_L(\alpha) + A_U(\alpha)]\, d\alpha = \frac{1}{4}(a + 2b + c).$$

Mathematical formulation of the proposed model

This part presents the mathematical formulation of the proposed model in cold and diffuse conditions. The attachments and assumptions will be used during this review.

The accompanying assumptions are made to ensure the simplicity of the model created:

"(1) Production and processing rates are limited and in line with the required rates. This suspicion suggests that the build rate is based on the rate of newly shipped products and the remanufacturing rate is based on the rate of remanufactured products.

(2) Assumes the case of a single article with two different characteristics and no gaps are allowed.

(3) During testing, some customers find that refurbished products are of lower quality than newly delivered products. As a result, it is accepted that refurbished products are generally not as good as brand new ones.

(4) Demand rates for newly manufactured and remanufactured products are high, regular but variable. This assumption is advantageous as there is a difference in quality between newly created products and remanufactured products sold in different industries.

(5) Used products (returns) are purchased and checked for a fee.

(6) The project horizon is unlimited.

(7) Collection rates for newly manufactured and remanufactured used products are stable but variable".

Eliminate the reverse logistics inventory model

"This subsection promotes a make-and-remake model with reverse logistics in cold climates. Like Richter's, the build and remake framework described in Figure 1 includes two stores. First warehouse (functional warehouse), supplies new products and prepares used products, which are continuously collected in the warehouse (repair warehouse). The remanufactured products are of secondary quality compared to the new one. In this sense, recently delivered products will be sold on the primary market, while refurbished products will be sold on the secondary market at a lower cost. Collecting used products from primary and secondary industries and the detection system is done at a reasonable cost. Dispose of non-repairable frame products at a cost and review repairable products. Demand is met by newly created and properly refurbished products, as shown in Figure 1. There are m reconditioning cycles each of length TR and n build cycles each of length TP during period T. No interest is vested in refurbished / returned products during construction / renovation cycles. Used repairable products are collected individually at

$\gamma_r\beta_r D_r$ and $\gamma_p\beta_p D_p$ rates during the mT_R and nT_P period.

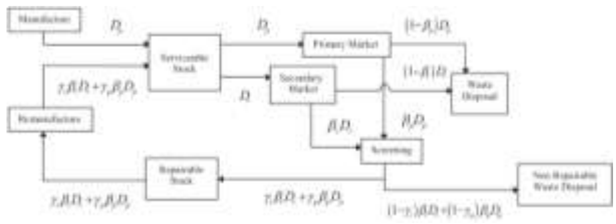

Fig. 1. Flow of materials for a manufacturing and processing plant.

"The model begins the restoration process (using repairable used products stored in previous build and restoration cycles). First, during the refurbishment cycle, the inventory of refurbished products increases due to the common relationship between refurbishments and the demand rate for refurbished products. It lasts until the time δT_R in which the regeneration is interrupted. From this point on, the inventory starts decreasing due to the fair interest rate and completely decreases over the TR time. This creates all m TR reflow patterns of the same length. Then, at that point, the cycles of creation begin to occur. At the start of a construction cycle, inventory is built up by the combined effect of the pace of construction and the demand for recently shipped products. It continues until the instant ηT_P in which the generation process is interrupted. Then at that time the inventory starts to decrease due to the fair interest rate and completely falls at the time TP. In this way, all n TP generation patterns of the same length are produced. Such an inventory picture for m = 2 and n = 3 is shown in Figure 2. In the beginning, when the restructuring begins, the stock of repairable inventory (used products) is depleted by the consolidated impact of the accumulation and renewal of repairable inventory . From this point on, the inventory changes due to the accumulation of repairable inventory. The same destocking / development process occurs every m update cycles. Thereafter the stock of repairable inventory increases during n construction cycles due to the accumulation of used products and reaches its maximum size at time T (as shown in Fig. 2)".

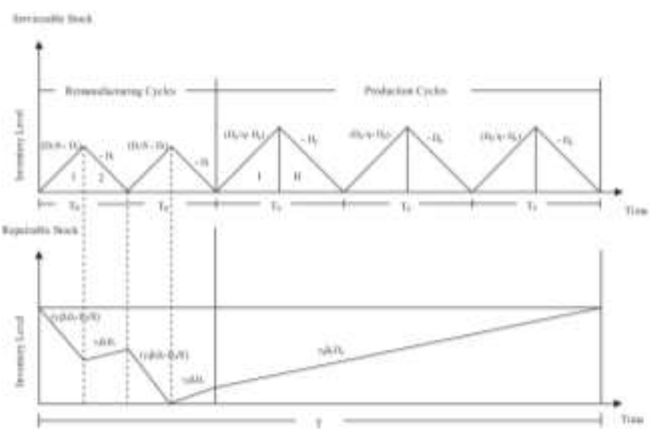

Fig. 2. Inventory system for m = 2, n = 3.

CONCLUSION

In this overview, we present a reverse logistics inventory model where construction and recycling rates are limited and requirements are subordinated. Various parts of the model outputs, such as storage costs, assembly costs, disposal costs, selection costs, extraction costs, construction costs, and remanufacturing costs, are considered three-sided fuzzy numbers. The total cost per seasonal unit of the created reverse logistics inventory framework is deciphered using the marked distance policy. At this point, the ideal build and repackage policy is determined to limit total spending. The presented article is described with a mathematical model. The U-shape of the total cost function is made accessible graphically. The main finding of the awareness survey is that repair is profitable in almost all circumstances, except when production costs are extremely low and repair costs are too high. In this way, the model introduced with these practical attributes comes very close to reasonable and stable circumstances to allow executives to organize and control construction and repackaging activities. This model can be further extended by considering the supply chain of at least two people. Likewise, it would be interesting to study the impact of by-products, the expansion and degradation of fossil fuels in future exploration. In addition, some other interesting extensions for future work are the consolidation of shortcomings, the correct deferral of installments and variable interest rates.

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