

Design Strategy for the Reverse Supply Chain Based on Time Value of Product*

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Abstract Design strategies for reverse supply chains are relatively unexplored and underdeveloped. The losses due to time delays represent a significant opportunity for asset recovery. Reverse supply chain design decisions should reflect the differences in the marginal value of time among products. The authors propose that reverse supply chain can be designed for cost efficiency or quick response, and the decision pivots on the product's time value. The paper analyzes the time value of return product in reverse supply chain, and the products are classified into low and high MVT based time value. In the paper both the efficient, centralized reverse supply chain matching the low MVT product and the responsive, decentralized reverse supply chain matching the high MVT product are designed. In addition, the paper presents some key technologies for designing the reverse supply chain.

Key words Reverse supply chain; Logistics management; Time value

1 Introduction

Reverse supply chain represents the process by which organizations recover by-products and residuals for reuse, resale, remanufacturing, recycling or disposal. Firms may engage in reverse supply chain activities for any number of reasons, such as return of defective mechanism to a supplier, recycling by-products from a manufacturing process, or a government-mandated product recall. Firms are beginning to recognize the importance of effective reverse supply chain systems. Government regulations with respect to the storage, handling, transport and disposal of residuals from manufacturing processes have forced organizations to establish formal disposal systems.

Key concepts of forward supply chain design—such as coordination, postponement, and the bullwhip effect—may be useful for the development of reverse supply chain design strategies, but these concepts have not been examined for their relevance in this context.

2 Time Value of Returned Product in Reverse Supply Chain

The flow of return products in reverse supply chain represents a sizeable asset stream for many companies, but much of that asset value is lost in the reverse supply chain. Managers, focused predominantly on the forward supply chain for new products, are often unaware of the magnitude of these losses and of how they occur. In fact, nearly half the asset value is lost in the return stream. Most of the loss in asset value falls into two categories: the returned product must be downgraded to a lower-valued product—a product once valued as new must be remanufactured, salvaged for parts, or simply scrapped as not repairable or obsolete; or, the value of the product decreases with time as it moves through the pipeline to its ultimate disposition. However, the losses due to time delays represent a significant opportunity for asset recovery. These losses include not only the deterioration in value of a returned product with time, but also the forced downgrading of product due to obsolescence.

Figure 1 illustrates the effects of time delays and product downgrading on asset loss in a return stream. The upper line in Figure 1 represents the declining value over time for a new product. The lower line indicates the declining value over time for a remanufactured version of the same product. Products near the end of their life cycle will show sharp decreases in the rate of value deterioration.

Because much of the recoverable asset loss in the return stream is due to time delays in processing, managers must be sensitive to the value of time for product returns and use it as a tool to (re)design the reverse supply chain for asset recovery. A simple, but effective, metric to measure the cost of delay is the product's marginal value of time: the loss in value per unit of time spent awaiting completion of the recovery process. The marginal value of time (MVT) is represented by the slopes of the lines in Figure 1

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The time value of returns is best represented in percentage terms to facilitate comparisons across products and product categories with different unit costs. The time value of returned products varies widely across industries and product categories. Time-sensitive, consumer electronics products such as PCs can lose value at rates in excess of 1% per week, and the rate increases as the product nears the end of its life cycle. At these rates, returned products can lose up to 10-20% of their value simply due to time delays in the evaluation and disposition process. On the other hand, a returned disposable camera body

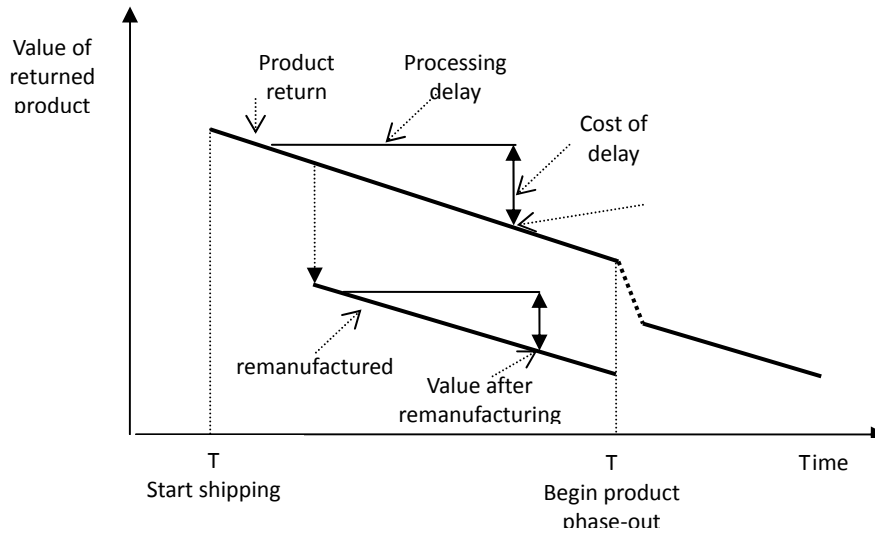


Figure 1 Time Value of Product Returns

or a power tool has a lower MVT; the cost of delay is usually closer to 1% per month. These differences in the marginal value of time are illustrated in Figure 2.

3 Reverse Supply Chain Design Decision

Reverse supply chain design decisions should reflect, and be driven by, differences in the MVT among products. If we classify products by time value, we can develop an analog of Fisher’s supply chain structure to maximize the value of recovered assets in the return stream.

If our objective is to maximize the net value of recovered assets, then the cost of managing the reverse supply chain must also be considered. Efficient supply chains sacrifice speed for cost efficiencies and, in a responsive chain, speed is usually achieved at higher cost. Viewed in this way, reverse supply chain design is a tradeoff between speed and cost efficiency. For products with high MVT (such as laptop computers), the high cost of time delays tips the tradeoff toward a responsive chain. For products with low marginal time values, delays are less costly and cost efficiency is a more appropriate objective. This suggests a supply chain design structure similar to the one Fisher proposes for forward supply chains; it is displayed as a two-dimensional matrix in Table 1. The right reverse supply chain matches responsiveness with high time value products and cost efficiency with low time value.

Table 1 Time-Based Reverse Supply Chain Design Strategy

	Efficient chain	Responsive chain
Low MVT product	Match	No match
High MVT product	No match	Match

The major structural difference between efficient and responsive reverse supply chains is the positioning of the evaluation activity in the supply chain— that is, where in the chain is testing and evaluation conducted to determine the condition of the product? If cost efficiency is the objective, then the returns supply chain should be designed to centralize the evaluation activity. On the other hand, if responsiveness is the goal, then a decentralized evaluation activity is needed to minimize time delays in processing returns.

3.1 Efficient reverse supply chains: the centralized model

A schematic of a returns supply chain with centralized testing and evaluation of returns is shown in Figure3. The reverse supply chain is designed for economies of scale—both in processing and transport of product. Every returned product is sent to a central location for testing and evaluation to determine its condition and issue credit. No attempt is made to judge the condition or quality of the product at the retailer or reseller. To minimize shipping costs, product returns are usually shipped in bulk. Once the condition of the product has been determined, it is channeled to the appropriate area (or facility) for disposition: restocking, refurbishment or repair, parts salvaging, or scrap recycling. Repair and refurbishment facilities also tend to be centralized, often outsourced. The supply chain is designed to minimize processing costs, often at the expense of long delays.

The centralized, efficient supply chain structure achieves processing economies by delaying credit issuance and testing, sorting, and grading until it has been collected at a central location. This approach has been widely adopted by managers of reverse supply chains, perhaps because it embodies a fundamental design principle of forward supply chains: postponement.

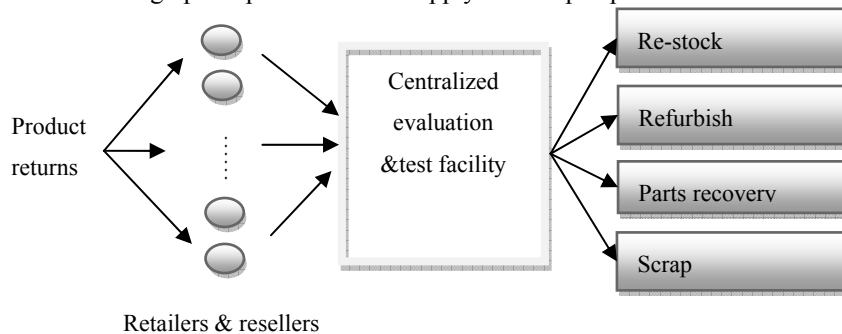


Figure 3 Centralized, Efficient Reverse Supply Chain

Postponement—or delayed product differentiation—has been used as an effective strategy for dealing with the cost of variety in forward supply chains. Manufacturing and stocking a basic product in generic form and delaying the addition of features, or options, until the product is closer to the customer has been used.

The centralized, efficient supply chain structure is also easier from the perspectives of the third-party provider offering credit issuances and the retailer who can send all the products back to a central location and do not have to sort returns and ship products to multiple locations.

3.2 Responsive supply chains: the decentralized model

In the reverse supply chain, there are significant time advantages to early, rather than late, process differentiation. Early diagnosis of product condition maximizes asset recovery by fast-tracking returns on to their ultimate disposition and minimizing the delay cost. To make the reverse supply chain responsive, the testing and evaluation of product must be decentralized. The reverse supply chain for one such responsive supply chain is displayed in Figure4. Instead of a single point of collection and evaluation, product is initially evaluated at multiple locations—when possible, at the point of return from the customer.

There are two important ways to decentralizing the returns process by reducing time delays. First, it reduces the time delays for disposition of new and scraps products; new, unused products tend to have the highest marginal time value and the most to lose from delays in processing. Second, and not so

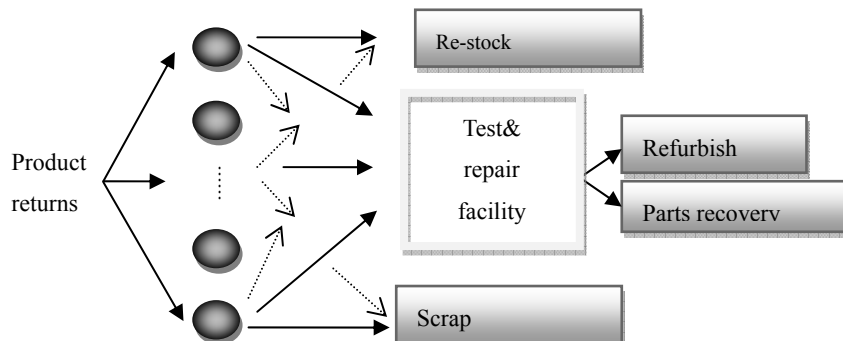


Figure 4 Decentralized, Responsive Reverse Supply Chain

obvious, decentralization also tends to speed up the processing of the remaining products—the units that need further testing and repair. By diverting the extremes of product condition (new and scrap) from the main returns flow, the flow of product requiring further evaluation, perhaps by remanufacturing specialists, is reduced. Reducing congestion for the flow of repairable product reduces the time delays in queuing and further diagnosis, thereby reducing the asset loss for these items as well.

There are two significant issues that must be addressed to achieve responsive, decentralized reverse supply chains. First is the question of technical feasibility— that is, being able to determine the condition of the product return in the field quickly and inexpensively. The second is the question of how to induce the reseller to do these activities at the point of return. Incentive alignment via shared savings contracts may be the best way to induce cooperation and coordination between the manufacturer and resellers, but firms must first know the value of such activities.

4 Conclusions

The losses due to time delays represent a significant opportunity for asset recovery. Reverse supply chain design decisions should reflect the differences in the marginal value of time among products. The reverse supply chain can be designed for cost efficiency or quick response, and the decision pivots on the product's time value. The time value of return product in reverse supply chain is analyzed and the products are classified into low and high MVT based time value. Both the efficient, centralized reverse supply chain matching the low MVT product and the responsive, decentralized reverse supply chain matching the high MVT product are designed in the paper.

A centralized reverse supply chain is cost efficient because it brings economies of scale in transportation and returns evaluation. If the product has a low marginal value of time (that is, its value decays slowly), then the returns supply chain should be designed for cost efficiency.

For products with a high MVT, responsive reverse supply chain can dramatically increase asset recovery. The decentralized model can eliminate much of the loss in that product segment, as well as reduce the return flow to only those units needing the attention of technicians.

If the product has a high marginal value of time, speed is critical and a decentralized reverse supply chain is appropriate. The product is evaluated as close as possible to the returns point and moved rapidly to its ultimate disposition.

Managers should give reverse supply chains as much attention as forward supply chains. Recognizing the significant value remaining in product returns and their time sensitivity are keys to designing their reverse supply chains. This is especially true for maturing markets such as consumer electronics, where there are declining margins. Poorly handled return streams and increasing returns volumes can quickly erode profits significantly.

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Research on BPR Application Aiming at Synergizing Marketing and Operation Processes*

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Abstract This study reviews several issues which are critical to the success of business process engineering from a customer perspective. Based on a literature review of methodologies, tools and techniques, this paper presents an reengineering approach for SMEs in synergizing marketing and operation function and enhancing information flow efficiency between them. The authors present a case study in YC flyash industrial ltd. Which applies the approach

Key words Business R'rocess reengineering; Marketing.nformation; Co-operation

1 Introduction

When target existing processes that are not ideally suited to address evolving operational and market needs, resources are often wasted. Enterprises often pursue process redesign to overcome this problem. While driven by the increased levels of competition, changes in customers' needs, IT changes, and changes in regulation(Grover et al., 1993). Both externally and internally, BPR is becoming one of the hottest topics in the management field.

Hammer (1990) first presented the concept of BPR as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed." Meanwhile, Davenport and Short(1990) emphasized the inter-reaction between organizations when addressing BPR.

BPR is not intended to preserve the status quo, but to drastically change what is done. Thus, it is essential for a BPR effort to focus on outcomes rather than tasks, and the required outcome will determine the scope of the BPR exercise. As Schaffer and Thomson (1992) highlighted how focusing on results rather than just activities makes the difference between success and failure in change programmes.

Considering the goal and the primary aim of BPR, according to Vantrappen(1992) and Chang(1994) , is to redesign processes with regard to improving performance from the customer's perspective.

Scherr(1993) saw that the importance of customers was enough to warrant using them as a perspective point when examining core processes. Sheehy(1997) interprets BPR's purpose as finding new ways of adding value to customers. Without the customer focus, Sheehy(1997) argues, "reengineering pulls inevitably towards a cost cutting exercise, this emphasis eventually reengineering the customer out of the picture(p.7)". Hall et al.(1993) argues that for BPR be successful, redesign efforts must be concentrated on areas that have the most direct impact on customer value and cost.

Terziovski et al. (2002) found that the proactive implementation of BPR as part of the organisation's business strategy, coupled with focusing BPR efforts on core-customer business processes are the most significant predictors of BPR success.

Andrews and Stalick(1992) stated that to successfully implement reengineering projects, companies need to follow a systematic approach. Even at its lowest level, BPR has a top-down approach (Hammer and Champy, 1993). Therefore, most BPR performed as a project (Earl and Khan, 1994) . They typically consist of several discrete phases(Carr and Johansson, 1995).

Klein proposed a four-stage approach of preparation, identification, vision, solution, and transformation.

Furey (1993)emphasized the importance of starting the BPR with determining customer needs and setting goals.

Johansson et al. (1993) simplified BPR into three steps, namely, discover, redesign and realise.

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