Decision and information models for streamlining recovery process

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Abstract
Paper focuses on developing a generic model that assists to choose the appropriate channel for returns items. To create a proper recovery model the different facets of a product disassembly would also need to be identified. Consequently, areas like modern information technologies that affect recovery capabilities will also be analyzed.

Keywords: (DIS) Decision Information Synchronization models, performance improvement

Introduction

Enterprises are aware of the significance of product returns & reprocessing options to recover value from and-of-use products. Looking at scale of value and volume required to be netted industry demands strategies to reorganize, restructure their process design to integrate functional forward supply system with return systems activities in a flexible and efficient way (Rogers and Tibben, 2001). Decision & information Synchronization (DIS) strategies can contribute to product recovery efforts in a competitive way. Proposed strategies can contribute in performance improvement not only on the distribution of new products but also reprocessing returns.

This study demonstrates a logical and interoperable methodology to model improvement in product recovery decision process, and synergies the role information accessibility/quality (Rogers et al. 2001). Suggesting scope of further improvement these strategies can advance towards facilitating recovery option selection of product returns during evolution of enterprise as an integrated system incorporating complexities of return process.

Product Recovery Decision & Information Synchronization (DIS) Model

A decent integrated decision & information support systems has tremendous potential to improve and facilitate implementation successful product recovery process (Listes, and Dekker, 2005). Further, to take full benefit a flexible product recovery system integrated with decision information system is vital. Primarily to appreciate recovery process investigators should considered it as typically an enterprise boundary-spanning process. DIS has potential to improve this enterprise inter-intra boundary interaction, since proposing a preliminary model will add unnecessary complexity (Vaart & Donk 2005). Therefore, proposed DIS model in a product

recovery system kept simple to understand. Information related to product returns and usage pattern while it's with customer should be integrated with information during forward flow of products. This is to be achieved for optimal planning for reduction in processing time and costs. In forward flow, returns can contribute as raw material or input resources, this will leads towards reduction in raw material requirement. Therefore, proposed DIS support network can be planned such that it can explicitly and efficiently serve for both forward and reverse product/information flows. To estimate recovery process efficiency "flexibility" facilitates recovery system planners to respond to external fluctuations in returns volumes and condition of return variants, along with internal variations of capacities. Hence, appealing integrated flexibility evaluations in return planning and decision practices offer a promising sustainable existence in competitive environment. Therefore, informationization along flexibility is the foundation for successful product recovery system (Daugherty et al., 2002, Rogers et. al., 2004, Kim et al. 2008, Huang et al. 2003). To illustrate product returns to OEM, the typical decision-making process to select recovery options are shown in Figure 1.

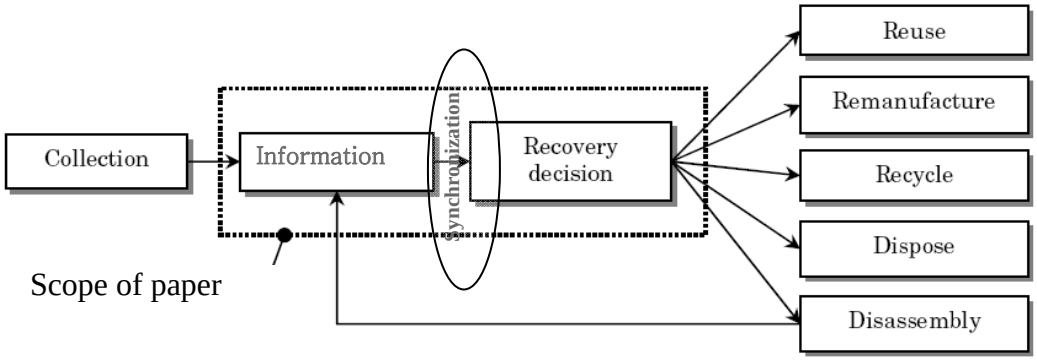

Figure 1: Process of Decision and Information sharing for product returns option selection in OEM

This section institute requirement for DIS strategies for product recovery process performance improvement. Further to establish prerequisite for proposed model study refers to Krikke et al. (1998) for developing criteria of feasibility (technological, ecological as well as economical) linked with product return information & decisions. Therefore, synergy between quality of information and promptness of decisions integrated with flexibility is prerequisite for an effective recovery system (Danese, 2006 & Wadhwa & Madaan 2007).

Flexible DIS Model for recovery system

An integrated product recovery process comprises management of discrete returns, evaluation products condition, and exchange of information reprocessing forward supply chain nodes. Return handlers directs products into reprocessing networks which will capture the remaining value. As mentioned previously timing and recovery option selection decisions can be improved at different information level. Analyzing from flexibility approach, the strategic issue is to select optimal degree of flexibility level to ensure competitive recovery operations which is challenging and uncertain, especially without product information and recovery decision support.

This integration will ensure enterprise will perform recovery process effectively and efficiently by getting products from where not required to somewhere value can captured by reselling, remanufacturing, recycling etc. Enterprise gets facilitation for in determining the ultimate purpose of returned products in recovery chain.

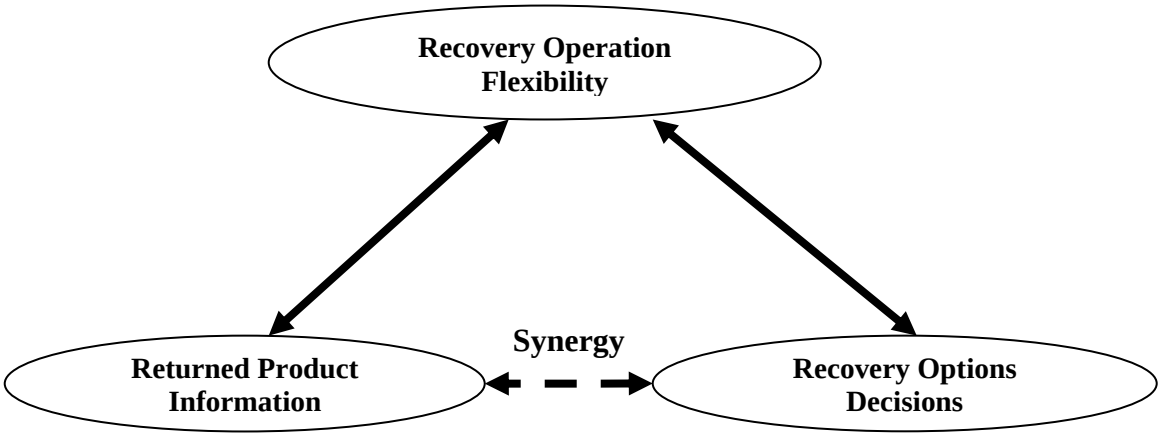

Figure 2: Integrated Flexibility and DIS model for recovery system

As shown in figure 2 enterprises synergies and incorporate information and decision in reverse recovery operation to exploit quality information by effective decision.

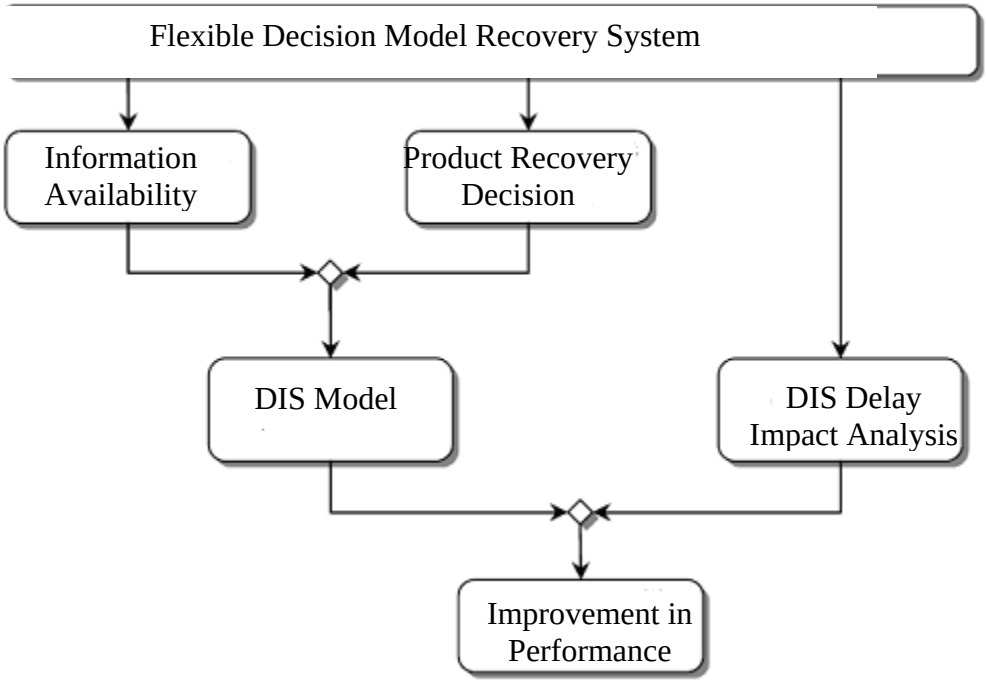

Figure 3: Streamlining operational flexibility of recovery process with DIS delay issues

Since the recovery operation delays, communication delays, option selection decision delays and being dispersed issues and have links to the forward flow systems performance also.

Enterprise have to incorporate the flexible recovery process design to attain control on flow of returns, flow of information and flow of cost along with significant factors like life cycle of returns in the product recovery process. The model for integrated flexible recovery operations with DIS has its application in efficient management of flow of values in returns. (Meade 2007, Lists & Dekker, 2003). Madaan et al., (2012), further proposed that it is vital to have quality and timely information to get better response in decisions for return processing option selection. In this paper we scrutinize accessibility of information obtained from established channels will impact the decisions related product's condition after return. The consequence of this study is to comprehend information and decision with & without delay can influence in the best recovery alternative under varying flexibility levels.

Sample DIS scenario for Streamlining Recovery and improving Performance

Here we demonstrate effect of DIS with penalty on delay (PD) on more specific resource type flexibility levels. Here figure 4 illustrates the deviation of cost of recovery operations with increasing level of routing flexibility to measure the impact of delay penalty. Results evidently shows that; (a) the advantage in spite of efficient DIS is reduced from 5.56% to -7.69%, in with highest level of flexibility (b) while keeping delay penalty to medium level i.e.2 gives maximum benefit with flexibility (c) cost follows increasing pattern at partial flexibility level of 3 with same delay penalty, (d) interestingly this pattern is remains unvarying at at different levels flexibility.

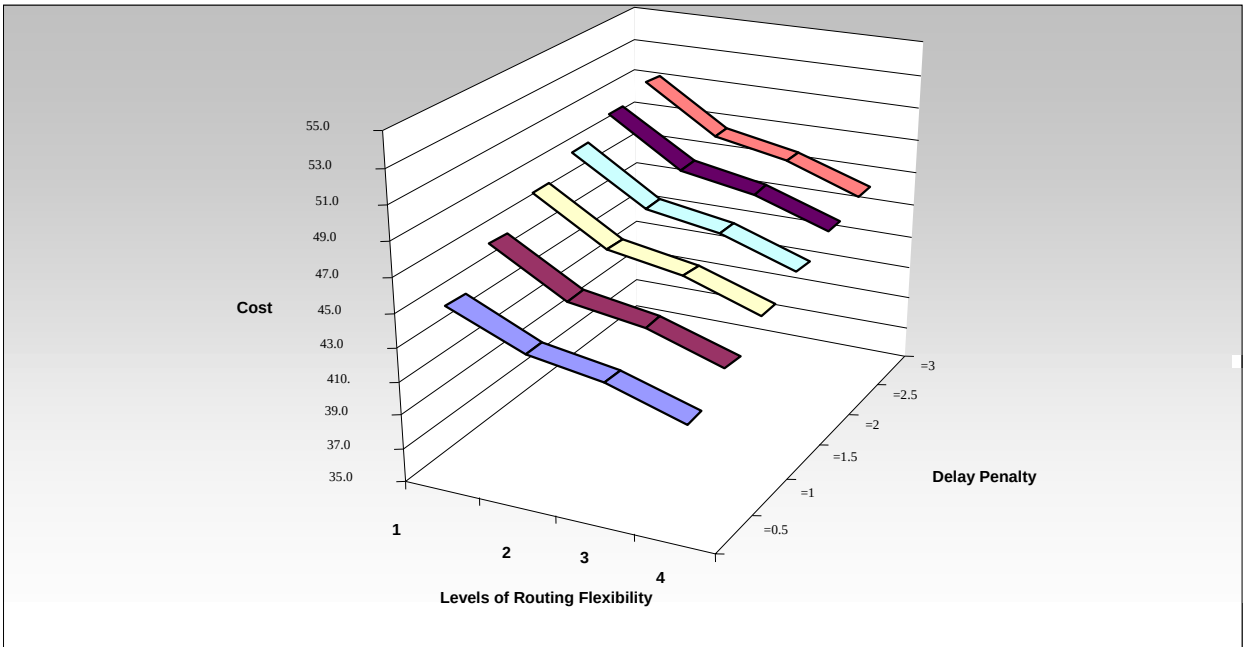

Figure 4: Impact of DIS Penalty on RTF

Combined influence DIS with routing & resource flexibility in RES

In this section, results are presented on the combined recovery process flexibility with DIS. The results of simulation experimentation has been analysed to measure the performance of product recovery process with combined flexibility i.e. RF+RTF in the case of DIS. Figure 5 illustrates the pattern of cost distribution with increasing flexibility level for both routing and resource combined. Results illustrate that; (a) the cost monotonously decreases with the increasing levels of RF and RTF with DIS (b) this effect is ununiformed at all flexibility levels, (c) the benefit of cost reduction is high in routing flexibility in all stages while resource flexibility gives significant improvement at first level, (d) second and third stage gives maximum influence with DIS case, (f) RF gives maximum influence on stage 3 while RTF gives maximum influence on stage 2.

The results indicate that the influence of supply chains combined flexibility with DIS on the overall supply chains cost is comparatively very strong and highly significant. Table 1 shows the pattern of cost reduction obtained with the increasing stages of recovery process flexibility. Under these conditions, the first stage of RTF with last stage of RF resulted in a cost based reduction by 47.62%, the subsequent levels resulted in a further reduction of 42.41%, 40.56%, and 37.36% respectively. In a reverse case the first stage of RF with last stage of RTF resulted in a cost based reduction by 5.77%, the subsequent levels resulted in a further reduction of 1.92%, 0.14%, -1.70%, and -1.57% respectively.

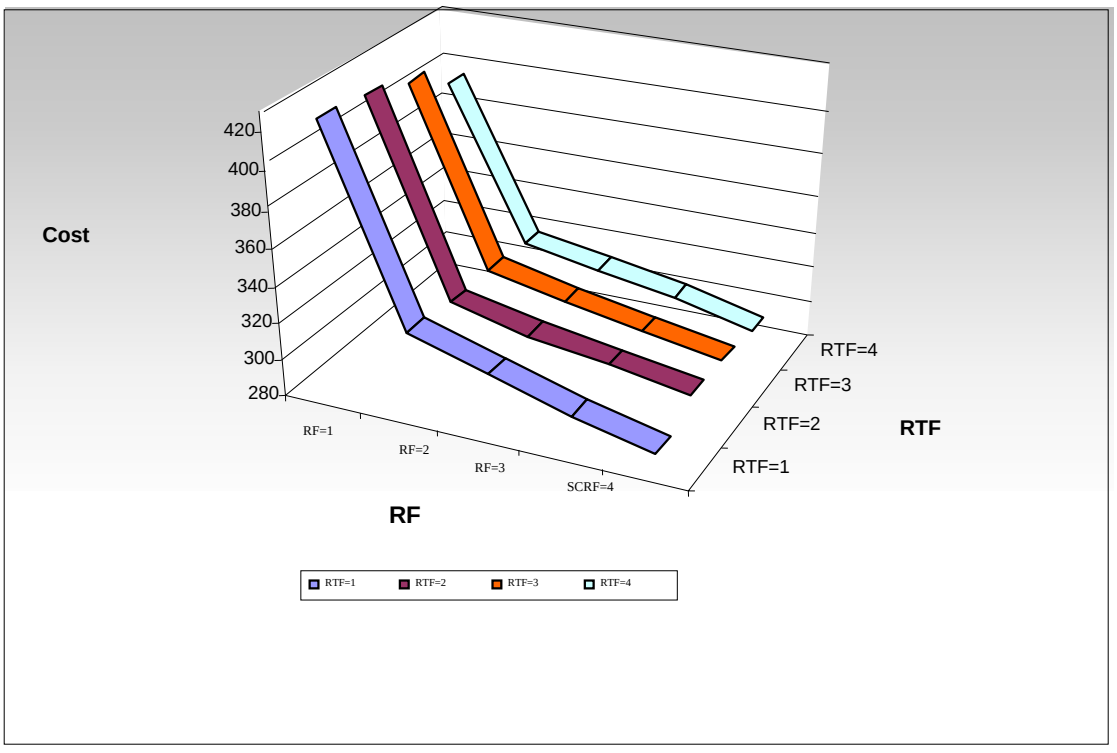

Figure 5: Combined influence of RF and RTF with DIS

Table 1 : Influence of RF & RTF at DIS Delay levels					
	RF- 1	2	3	4	
RTF-1					47.622
2					42.414
3					40.568
4					37.366
	5.772	1.922	0.148	-1.576	45.295

In terms of the percentage of total cost reductions with the increasing levels of flexibility, it is observed that the combined flexibility gives a benefit of 45.29% (RF+RTF=1 to RF+RTF=5). Recovery operations should focus on speedy decision to capture the value of product returns and facilitated with the information of product condition at the point of return. Efforts are required for type, the flow path and the factors effecting products conditions (Uster et al. 2007). It is vital for industries to develop flexibility in systematic way (Madaan et al.2015). This is to be done to evaluate the flexibility deficit in the returns, the individual and combined RF and RTF flexibilities to be considered, and should be done so systematically because of the hierarchical dependencies in the recovery system. As illustrated in Table 1, whereby lower RF and RTF flexibility adversely affect the cost. Thus in terms of the flexibility analysis of the enterprises, it quickly became apparent that their recovery operations exhibits major flexibility bottlenecks. In general, the evaluation approach used in this approach is well accepted despite the issues in data acquirement from industry.

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Conclusion

Paper has revealed the influence of changing levels sharing of information with decision responsiveness along with DIS delays. Effect of delay penalties on performance of entire recovery process in terms of cost is also shown. Study specifies that the DIS integration with routing and resource flexibility across the recovery chain has crucial influence cost effectiveness of the recovery process. Result presented here are extension research to study influence flexibility types and DIS delays under recovery scenarios. In future studies we can quantitatively measure the influence of availability and quality return product information that are made at present and how uncertainties can influence the effectiveness of these decisions.

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