

The Macrotheme Review

A multidisciplinary journal of global macro trends

An Overview of Research Characteristics on Reverse Logistics

Mohamad Tabikh

MÅLARDALEN UNIVERSITY, IDT, SWEDEN

Abstract

This paper aims to spotlights the main characteristics of research on reverse logistics, and that by describing and analyzing articles related to production and operations management field. For this target, a database was built based on articles published within prestigious scientific journals for the year 2012, and then the next process was exploring the research topic, methodology and the techniques of analysis. The results are an overview of research works on reverse logistics that presents clear vision of researcher interests and their trends of concentration into future research

Keywords: Reverse Logistics; Literature review; Production and operations management; Product recovery

1. Introduction

Reverse Logistics is an area that growing attention in recent years and this phenomenon come into sight of researchers particularly in production and operations management field. The interest by academic community and supply chain practitioners appears clearly through many scientific articles within various international journals. In view of this interest, the proposed paper spotlights the main characteristics of research on reverse logistics such as the evolution of research; classification of research topics; methodologies and techniques of data analysis. In this respect, the objective is to analyze and evaluate scientific articles contained by most prestigious journals that considered having works on the concept of reverse logistics. This study cover only published articles in the year 2012, and that in reason of time limitation for tackling wider analysis in accurate manner. Furthermore, the core vision is to provide deepen knowledge about reverse logistics and highlights directions in which the future investigators could focus on.

Kai Chan et al. (2010) gives a brief description of reverse logistics case whilst compared to its counterpart, forward logistics, “research in reverse logistics is still in its infancy”, even though the concept of reverse logistics evolved over the years until becoming consolidated (de Brito and Dekker, 2004). Among many definitions that have been suggested for this concept, the proposal of Rogers et al. (2012) shows the most integrated definition given to reverse logistics. They define reverse logistics as “The process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal”. Therefore, the selected journals and articles based on contents that support this definition and excluding others that might not add values to this tenor.

Consequently, by giving these premises, the rest of this paper is structured as follows: first describe the methodology that has employed to build the database of articles to be analyzed. Then present the main research topics within reverse logistics field, methodologies and general view of the data analysis techniques. Moreover, outlining the main findings of this work and utilize these results in forming the final conclusion.

2. Methodology

The data collected through formal sources for instance university library database, in which facilitates the search process. For ease of simplifying work, only selected scientific journals been considered for this analysis, especially the ones that include studies correlated to reverse logistics in the year 2012. Further reason for picking year 2012 instead of another year was the completeness of publications that covers full year from January to December. In contrast, year 2013 does not satisfy the condition since the year is not finished yet.

These chosen articles were centered on areas of ‘Business Management’ and ‘Operation Research and Management Science’ because these topics most likely include publications on the concept of reverse logistics (*Rubio et al. 2008*). On this context, *ISI Journal of Citation Reports (2012)* used to sort journals based on impact factors, this helps to choose journals that having high effects into production and operations management. Afterwards convenient articles gathered and analysis stage starts.

As pointed out earlier, the fundamental approach of study is to analyze articles among reverse logistics borders. For this reason, the literature search using terms ‘reverse logistics’ and/or ‘product recovery’ in the title, abstract or keywords of articles appearing in journals during the period of analysis carried out (*Rubio et al. 2008*). Thus, the database was completed, which contained a total of 61 articles published in 9 journals (*see table 1*). Once the database had built up, the analysis treat each article based on data collection sheet that includes information concerning the research topics, the methodology followed and the techniques of analysis employed.

Table 1. List of Journals

Journal	Articles
Computers & Industrial Engineering	3
Computers & Operations Research	1
European Journal of Operational Research	5
International Journal of Production Economics	16
International Journal of Production Research	22
Production Planning & Control	7
Transportation Research Part E: Logistics and Transportation Review	5
International Journal of Physical Distribution & Logistics Management	1
Industrial Marketing Management	1
Total	61

In purpose of standardizing work in logical basis, the scientific recognition was necessary to classify research topics in reverse logistics into three areas. Firstly, ‘The management of the recovery and distribution of end-of-life products’; secondly, ‘Production planning and inventory management’, and finally, ‘Supply chain management issues in reverse logistics’ (*Dekker et al. 2004*).

The first research topic, 'Management of the recovery and distribution of end-of-life products', based search and analysis into articles include works in different physical flows exists, particularly those issues in collection and distribution of end-of-life (EOL) products. Thus aspects related to network design; flows interaction (forward and reverse), transportation routes or questions of inbound logistics, among others are covered by this research topic.

The topic 'Production planning and inventory management' involves those works that discuss the coordination of EOL product recovery processes respect to traditional production planning. The inquiries in cases dealing with interactive phase of reverse logistics management. In addition to issues comprising inventory control, whilst EOL products generates in traditional models of inventory management, as well the economic recovery operations in allocating manufacturing operations (remanufacturing, recycling, reuse).

The last topic, 'Supply chain management issues in reverse logistics' concerns those works that analyzes organizational and strategic decisions, in which reverse flow of EOL products generates in supply chain management (SCM). For aiming certainty, questions such as long-term performance of closed-loop supply chains, IT and its roles in reverse logistics and how it SCM, the impact of environmental constraints into SCM through RL, among others are included in this topic (*Rubio et al. 2008*).

The articles framed among each research topic by reviewing the title, abstract, keywords and general view of paper main body. This procedure repeated over and over in each article to validate the research topic classification, and incase of doubt topic the decision considered the approximation of one of three research topics.

Proceeding to next step, the study analyzes each article methodology and setting-up methodologies collection sheet rely on similar work in characteristics of research on reverse logistics wherein included methodologies such as case studies, literature review, mathematical model and survey.

Finally the techniques employed for the data analysis embraces understanding of the main body of the work and then constructing analysis methods commensurate similar work in analytic advances, like: the case analysis, control theory, descriptive analysis, mathematical programming, optimization, markov process and simulation.

3. Results

According to Rubio et al. (2008), the number of articles found related to reverse logistics were 35 papers in year 2005. However, this study presenting 61 articles in 2012 expresses the evolution of research on reverse logistics by 74.2% (figure 1). The increasing rate of publications indicates spectacular growth in researcher interest towards environmental issues associated with production and operations management. One more reason is the attempting for industrial excellence of integrating business processes among closed-loop supply chain supported by agile reverse flows.

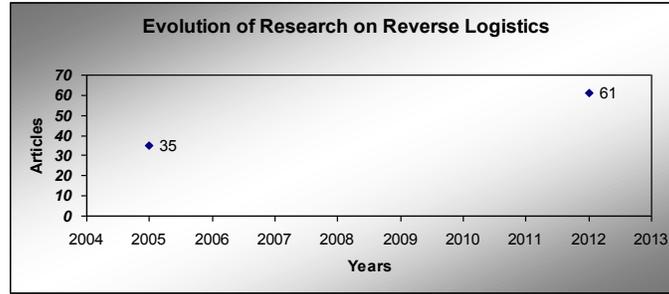


Fig. 1. Number of articles published in year 2005 and 2012

Through analyzing the articles by research topics, the first observation takes place that 32.7% (20 articles) included within the topic ‘Management of the recovery and distribution of end-of-life products’, 34.4% (21 articles) framed within the topic ‘Production planning and inventory management’, while 32.7% (20 articles) of articles discussed questions related to ‘Supply chain management issues in reverse logistics’.

Moreover, *Int J. Prod. Res.*, has 55% (11 articles) of total ‘Management of the recovery and distribution of end-of-life products’ articles. In addition to *Journal Prod. Plan. Control.*, includes 33.3% (7 articles) of total ‘Production planning and inventory management’ articles beside *Int. J. Prod. Econ.*, has 40% (8 articles) of total ‘Supply chain management issues in reverse logistics’ articles (Table 2).

Table 2. Journal and Research topic

Journal	Management of the recovery and distribution of EOL products	Production planning and inventory management	Supply chain management issues in reverse logistics	Total
Computind. Eng.	1 5%	2 9.5%	0 0.00%	3
Comput. Oper. Res.	1 5%	0 0.00%	0 0.00%	1
Eur. J. Oper. Res.	2 10%	2 9.5%	1 5%	5
Int. J. Prod. Econ.	2 10%	6 28.5%	8 40%	16
Int J. Prod. Res.	11 55%	4 19%	7 35%	22
Prod. Plan. Control.	0 0.00%	7 33.3%	0 0.00%	7
Transport. Res. E-Log.	3 15%	0 0.00%	2 10%	5
IJPD&Lm.	0 0.00%	0 0.00%	1 5%	1
Ind. Market. Manag.	0 0.00%	0 0.00%	1 5%	1
Total	20 32.7%	21 34.4%	20 32.7%	61

During the analysis of employed methodologies within selected articles (61), both quantitative and qualitative methods appear in different portions as shown in *figure 2*. The highest chosen methodology dealt with reverse logistics is mathematical model, and the lowest one is survey.

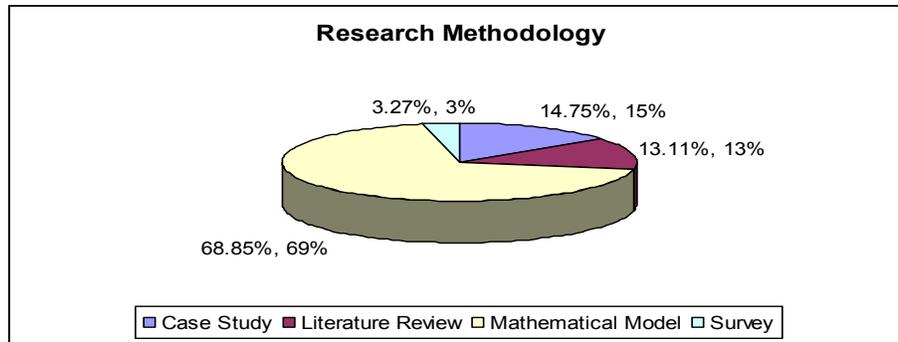


Fig. 2. Research Methodology

Furthermore, whilst sorting the research topic and methodologies (table 3) the application based on number of articles contained. The results distribute into: ‘Supply chain management issues in reverse logistics’ includes 44.44% (4 articles) and 62.5% (5) of total case study and literature review articles 14.75% (9); 13.11% (8) respectively. Then ‘Production planning and inventory management’ embraces 42.85% (18) of total mathematical model articles 68.85% (42). However ‘Management of the recovery and distribution of EOL products’ share ‘Supply chain management issues in reverse logistics’ 50% (1) of total survey articles 3.27% (2), see table 4.

Table 3. Articles by topic and methodology

	Case Study	Literature Review	Mathematical Model	Survey
Management of the recovery and distribution of EOL products	Dowlatshahi, 2012 Ozkor& Başligil, 2012 Carrasco-Gallego et al., 2012	Besiou et al., 2012 Mishra et al., 2012	Assavapokee& Wongthatsanekorn, 2012 Liberatore et al., 2012 Dong& He, 2012 Das& Chowdhury, 2012 Chen& Bell, 2012 Kleber et al., 2012 Lieckens& Vandaele, 2012 Pochampally& Gupta, 2012 Piplani& Saraswat, 2012 Mahapatra et al., 2012 Hasani et al., 2012 Lee et al., 2012 Chen-y et al., 2012 Vahdani et al., 2012	Ramirez, 2012
Production planning and inventory management	Xu et al., 2012 Ilgin et al., 2012	Lage Jr& GodinhoFilho, 2012	Ko et al., 2012 Mitra, 2012 Flapper et al., 2012 Chen et al., 2012 Kenne et al., 2012 Rahman& Subramanian, 2012 Zhang et al., 2012 Widyadana& Wee, 2012 Pokhare& Liang, 2012 Robotis et al., 2012 Minner& Kiesmüller, 2012 Alinovi et al., 2012 Nenes& Nikolaidis, 2012 Abdallah& Simchi-Levi, 2012 Corominas et al., 2012 Loomba& Nakashima, 2012 Godichaud et al., 2012 Huang et al., 2012	
Supply chain management issues in reverse logistics	Govindan et al., 2012 Sharif et al., 2012 Hong& Yeh, 2012 Lee& Lam, 2012	Hazen et al., 2012 Abdulrahman& Gunasekaran, 2012 Jain, 2012 Chan et al., 2012 Hazen et al., 2012	Wu, 2012 Lundin, 2012 Li et al., 2012 Toptal, 2012 Nativi& Lee, 2012 Li-x et al., 2012 Das, 2012 Godichaud et al., 2012 Subramanian et al., 2012 Chen& Chang, 2012	Adenso-Díaz et al., 2012

Table 4. Research topic and methodology

Research topic	Case Study	Literature Review	Mathematical Model	Survey
Management of the recovery and distribution of EOL products	3 (33.33%)	2 (25%)	14 (33.33%)	1 (50%)
Production planning and inventory management	2 (22.22%)	1 (12.5%)	18 (42.85%)	
Supply chain management issues in reverse logistics	4 (44.44%)	5 (62.5%)	10 (23.80%)	1 (50%)
Total	9 (14.75%)	8 (13.11%)	42 (68.85%)	2 (3.27%)

The final synthesis of techniques utilized for data analysis in articles (61 articles) shown as following (Table 5). ‘Management of the recovery and distribution of EOL products’ includes 50% (6 articles) and 58.33% (7) of total case analysis 19.67% (12), and mathematical programming 19.67% (12). The ‘Production planning and inventory management’ framed respectively 100% (4), 55.55% (5), 66.66% (2), and 66.66% (6) of total control theory 6.55% (4); optimization 14.75% (9); markov process 4.91% (3); and simulation 14.75% (9). Nevertheless ‘Supply chain management issues in reverse logistics’ consists of various distributed percentages as 58.33% (7) of total descriptive analysis 19.67% (12) articles.

Table 5. Techniques employed for data analysis

Research topic	Case analysis	Control theory	Descriptive analysis	Mathematical programming	Optimization	Markov process	Simulation
Management of the recovery and distribution of EOL products	6 (50%)		4 (33.33%)	7 (58.33%)	2 (22.22%)		1 (11.11%)
Production planning and inventory management	1 (8.33%)	4 (100%)	1 (8.33%)	2 (16.66%)	5 (55.55%)	2 (66.66%)	6 (66.66%)
Supply chain management issues in reverse logistics	5 (41.66%)		7 (58.33%)	3 (25%)	2 (22.22%)	1 (33.33%)	2 (22.22%)
Total	12 (19.67%)	4 (6.55%)	12 (19.67%)	12 (19.67%)	9 (14.75%)	3 (4.91%)	9 (14.75%)

4. Conclusion

Reverse logistics getting enormous attention recently, and that expressed along the current study wherein the number of articles much greater than previous research analysis. The environmental aspects in green supply chain management attract researchers to investigate further within production and operations field. However, the economical crisis force companies to adopt new methods such as lean production in order to drives their return on investment ahead, and integrates forward as well as reverse logistics in flexible system.

Regarding the research topics, the 'Production planning and inventory management' area contains more articles compared to others research topics. This variation resulting from the practical difficulties that encountered firms through implementing reverse logistics on daily basis, and the interactions with traditional production and inventory management (*Journal of Prod.Plan.Control*). Furthermore, Both *Int.J.Prod.Res* and *Int.J.Prod.Econ*, has the highest number of research works on reverse logistics. The research methodology on reverse logistics constitute mainly by mathematical model 68.85% in which gives bright understanding of nowadays research trends. However, other methodologies are important and needs more attention such as survey. The techniques employed for data analysis gives brief view about the way been these works data's analyzed. The Case analysis, descriptive analysis, and mathematical programming own the highest rank among all other techniques.

Consequently, this current work presents an overview of research characteristics on reverse logistics by providing a database of articles dealt with production and operations management field. The idea is to classify those articles into specific research topic and then analyzing their methodologies and pointed out the techniques of data analysis.

References

- Abdallah, T. and Simchi-Levi, D., Sustainable supply chain design: a closed-loop formulation and sensitivity analysis. *Prod. Plan. Control*, 2012, **23**, 120-133
- Abdulrahman, M.D., Gunasekaran, A. and Subramanian, N., Critical barriers in implementing reverse logistics in the Chinese manufacturing sectors. *Int. J. Prod. Econ.*, 2012, In Press
- Adenso-Díaz, B., Moreno, P., Gutiérrez, E. and Lozano, S., An analysis of the main factors affecting bullwhip in reverse supply chains. *Int. J. Prod. Econ.*, 2012, **135**, 917-928
- Alinovi, A., Bottani, E. and Montanari, R., Reverse Logistics: a stochastic EOQ-based inventory control model for mixed manufacturing/remanufacturing systems with return policies. *Int. J. Prod. Res.*, 2012, **50**, 1243-1264
- Assavapokee, T. and Wongthatsanekorn, W., Reverse production system infrastructure design for electronic products in the state of Texas. *Comput ind. Eng.*, 2012, **62**, 129-140
- Besiou, M., Georgiadis, P. and Van Wassenhove, L.N., Official recycling and scavengers: Symbiotic or conflicting?. *Eur. J. Oper. Res.*, 2012, **218**, 563-576
- Carrasco-Gallego, R., Ponce-Cueto, E. and Dekker, R., Closed-loop supply chains of reusable articles: a typology grounded on case studies. *Int. J. Prod. Res.*, 2012, **50**, 5582-5596
- Chan, H.K., Yina, S. and Chanb, F.T.S., Implementing just-in-time philosophy to reverse logistics systems: a review. *Int. J. Prod. Res.*, 2010, **48**, 6293-6313
- Chan, T.S.F., Chan, H.K. and Jain, V., A framework of reverse logistics for the automobile industry. *Int. J. Prod. Res.*, 2012, **50**, 1318-1331
- Chen, J. and Bell, P.C., Implementing market segmentation using full-refund and no-refund customer returns policies in a dual-channel supply chain structure. *Int. J. Prod. Econ.*, 2012, **136**, 56-66

- Chen, J. and Chang, C-I., The co-opetitive strategy of a closed-loop supply chain with remanufacturing. *Transport. Res. E-Log.*, 2012, **48**, 387-400
- Chen, J., Zhao, X. and Zhou, Y., A periodic-review inventory system with a capacited backup supplier for mitigating supply disruptions. *Eur. J. Oper. Res.*, 2012, **219**, 312-323
- Chen, Y.J., Sheu, J. and Lirn, T., Fault tolerance modeling for an e-waste recycling supply chain. *Transport. Res. E-Log.*, 2012, **48**, 897-906
- Corominas, A., Lusa, A. and Olivella, J., A manufacturing and remanufacturing aggregate planning model considering a non-linear supply function of recovered products. *Prod. Plan. Control*, 2012, **23**, 194-204
- Das, K., Integrating reverse logistics into the strategic planning of a supply chain. *Int. J. Prod. Res.*, 2012, **50**, 1438-1456
- Das, K. and Chowdhury, A.H., Designing a reverse logistics network for optimal collection, recovery and quality-based product-mix planning. *Int. J. Prod. Econ.*, 2012, **135**, 209-221
- De Brito, M. and Dekker, R., A framework for reverse logistics. In *Reverse Logistics. Quantitative Models for Closed-Loop Supply Chains*, edited by R. Dekker, M. Fleischmann, K. Inderfurth and L.N. Van Wassenhove, pp. 3–27, 2004 (Springer-Verlag, Germany)
- Dekker, R., Fleischmann, M., Inderfurth, K. and Van Wassenhove, L.N. (Eds.), *Reverse Logistics: Quantitative Models for Closed-Loop Supply Chains*, 2004. (Springer-Verlag: Germany)
- Dong, M. and He, F., A new continuous model for multiple re-entrant manufacturing systems. *Eur. J. Oper. Res.*, 2012, **223**, 659-668
- Dowlatshahi, S., A framework for the role of warehousing in Reverse Logistics. *Int. J. Prod. Res.*, 2012, **50**, 1265-1277
- Flapper, S.D.P., Gayon, J.P. and Vercaene, S., Control of a production-inventory system with returns under imperfect advance return information. *Eur. J. Oper. Res.*, 2012, **218**, 392-400
- Godichaud, M., Pérès, F. and Tchangani, A., Optimising end-of-life system dismantling strategy. *Int. J. Prod. Res.*, 2012, **50**, 3738-3754
- Godichaud, M., Tchangani, A., Pérès, F. and Iung, B., Sustainable management of end-of-life systems. *Prod. Plan. Control*, 2012, **23**, 216-236
- Govindan, K., Palaniappan, M., Zhu, Q. and Kannan, D., Analysis of third party reverse logistics provider using interpretive structural modeling. *Int. J. Prod. Econ.*, 2012, **140**, 204-211
- Hasani, A., Zegordi, S.H. and Nikbakhsh, E., Robust closed-loop supply chain network design for perishable goods in agile manufacturing under uncertainty. *Int. J. Prod. Res.*, 2012, **50**, 4649-4669
- Hazen, B.T., Hall, D.J. and Hanna, J.B., Reverse logistics disposition decision-making. Developing a decision framework via content analysis. *IJPD&Lm.*, 2012, **42**, 244-274
- Hazen, B.T., Overstreet, R.E., Jones-Farmer, L.A. and Field, H.S., The role of ambiguity tolerance in consumer perception of remanufactured products. *Int. J. Prod. Econ.*, 2012, **135**, 781-790
- Hong, I. and Yeh, J., Modeling closed-loop supply chains in the electronics industry: A retailer collection application. *Transport. Res. E-Log.*, 2012, **48**, 817-829
- Huang, Y., Jim, Y. and Rahman, S., The task environment, resource commitment and reverse logistics performance: evidence from the Taiwanese high-tech sector. *Prod. Plan. Control*, 2012, **23**, 851-863
- Ilgin, M.A., Ondemir, O. and Gupta, S.M., An approach to quantify the financial benefit of embedding sensors into products for end-of-life management: a case study. *Prod. Plan. Control*, 2012, DOI:10.1080/09537287.2012.655801

- Jain, V., Special issue on sustainable supply chain management and reverse logistics. *Int. J. Prod. Res.*, 2012, **50**, 1239-1242
- Kenne, J., Dejax, P. and Gharbi, A., Production planning of a hybrid manufacturing–remanufacturing system under uncertainty within a closed-loop supply chain. *Int. J. Prod. Econ.*, 2012, **135**, 81-93
- Kleber, R., Schulz, T. and Voigt, G., Dynamic buy-back for product recovery in end-of-life spare parts procurement. *Int. J. Prod. Res.*, 2012, **50**, 1476-1488
- Ko, Y.D, Noh, I. and Hwang, H., Cost benefits from standardization of the packaging glass bottles. *Comput ind. Eng.*, 2012, **62**, 693-702
- Lage Jr., M. and Godinho Filho, M., Production planning and control for remanufacturing: literature review and analysis. *Prod. Plan. Control*, 2012, **23**, 419-435
- Lee, C.K.M. and Lam, J.S.L., Managing reverse logistics to enhance sustainability of industrial marketing. *Ind. Market. Manag.*, 2012, **41**, 589-598
- Lee, Y.J., Baker, T. and Jayaraman, V., Redesigning an integrated forward–reverse logistics system for a third party service provider: an empirical study. *Int. J. Prod. Res.*, 2012, **50**, 5615-5634
- Li, X., Li, Y. and Cai, X., Quantity decisions in a supply chain with early returns remanufacturing. *Int. J. Prod. Res.*, 2012, **50**, 2161-2173
- Li, Y., Wei, C. and Cai, X., Optimal pricing and order policies with B2B product returns for fashion products. *Int. J. Prod. Econ.*, 2012, **135**, 637-646
- Liberatore, F., Ortuño, M.T., Tirado, G., Vitoriano, B. and Scaparra, M.P., A hierarchical compromise model for the joint optimization of recovery operations and distribution of emergency goods in Humanitarian Logistics. *Comput Oper. Res.*, 2012, In Press
- Lieckens, K. and Vandaele, N., Multi-level reverse logistics network design under uncertainty. *Int. J. Prod. Res.*, 2012, **50**, 23-40
- Loomba, A.P.S. and Nakashima, K., Enhancing value in reverse supply chains by sorting before product recovery. *Prod. Plan. Control*, 2012, **23**, 205-215
- Lundin, J.F., Redesigning a closed-loop supply chain exposed to risks. *Int. J. Prod. Econ.*, 2012, **140**, 596-603
- Mahapatra, S., Pal, R. and Narasimhan, R., Hybrid (re)manufacturing: manufacturing and operational implications. *Int. J. Prod. Res.*, 2012, **50**, 3786-3808
- Minner, S. and Kiesmüller, G.P., Dynamic product acquisition in closed loop supply chains. *Int. J. Prod. Res.*, 2012, **50**, 2836-2851
- Mishra, N., Kumar, V. and Chan, F.T.S., A multi-agent architecture for reverse logistics in a green supply chain. *Int. J. Prod. Res.*, 2012, **50**, 2396-2406
- Mitra, S., Inventory management in a two-echelon closed-loop supply chain with correlated demands and returns. *Comput ind. Eng.*, 2012, **62**, 870-879
- Nativi, J.J. and Lee, S., Impact of RFID information-sharing strategies on a decentralized supply chain with reverse logistics operations. *Int. J. Prod. Econ.*, 2012, **136**, 366-377
- Nenes, G. and Nikolaidis, Y., A multi-period model for managing used product returns. *Int. J. Prod. Res.*, 2012, **50**, 1360-1376
- Rahman, S. and Subramanian, N., Factors for implementing end-of-life computer recycling operations in reverse supply chains. *Int. J. Prod. Econ.*, 2012, **140**, 239-248
- Piplani, R. and Saraswat, A., Robust optimisation approach to the design of service networks for reverse logistics. *Int. J. Prod. Res.*, 2012, **50**, 1424-1437
- Pochampally, K.K. and Gupta S.M., Use of linear physical programming and Bayesian updating for design issues in reverse logistics. *Int. J. Prod. Res.*, 2012, **50**, 1349-1359

- Pokharel, S. and Liang Y., A model to evaluate acquisition price and quantity of used products for remanufacturing. *Int. J. Prod. Econ.*, 2012, **138**, 170-176
- Ramírez, A.M., Product return and logistics knowledge: Influence on performance of the firm. *Transport. Res. E-Log.*, 2012, **48**, 1137-1151
- Robotis, A., Boyaci, T. and Verter, V., Investing in reusability of products of uncertain remanufacturing cost: The role of inspection capabilities. *Int. J. Prod. Econ.*, 2012, **140**, 385-395
- Rogers, D.S., Melamed, B. and Lembke, R.S., Modeling and Analysis of Reverse Logistics. *J. Bus. Log.*, 2012, **33**, 107-117
- Rubio, S., Chamorro, A. and Miranda, F.J., Characteristics of the research on reverse logistics (1995–2005). *Int. J. Prod. Res.*, 2008, **46**, 1099-1120
- Sharif, A.M., Irani, Z., Love, P.E.D. and Kamal, M.M., Evaluating reverse third party logistics operations using a semi-fuzzy approach. *Int. J. Prod. Res.*, 2012, **50**, 2515-2532
- Subramanian, P., Ramkumar, N., Narendran, T.T. and Ganesh, K., A technical note on ‘Analysis of closed loop supply chain using genetic algorithm and particle swarm optimisation’. *Int. J. Prod. Res.*, 2012, **50**, 593-602
- Toptal, A., Integration of shipment scheduling decisions for forward and reverse channels in a recoverable item system. *Int. J. Prod. Econ.*, 2012, **140**, 129-137
- Vahdani, B., Tavakkoli-Moghaddam, R., Modarres, M. and Baboli, A., Reliable design of a forward/reverse logistics network under uncertainty: A robust-M/M/c queuing model. *Transport. Res. E-Log.*, 2012, **48**, 1152-1168
- Widyadana, G.A. and Wee, H.M., An economic production quantity model for deteriorating items with multiple production setups and rework. *Int. J. Prod. Econ.*, 2012, **138**, 62-67
- Wu, C., Product-design and pricing strategies with remanufacturing. *Eur. J. Oper. Res.*, 2012, **222**, 204-215
- Xu, X., Li, Y. and Cai, X., Optimal policies in hybrid manufacturing/remanufacturing systems with random price-sensitive product returns. *Int. J. Prod. Res.*, 2012, **50**, 6978-6998
- Zhang, Z., Jiang, H. and Pan, X., A Lagrangian relaxation based approach for the capacitated lot sizing problem in closed-loop supply chain. *Int. J. Prod. Econ.*, 2012, **140**, 249-255
- Özkır, V. and Başlıgıl, H., Modelling product-recovery processes in closed-loop supply-chain network design. *Int. J. Prod. Res.*, 2012, **50**, 2218-2233