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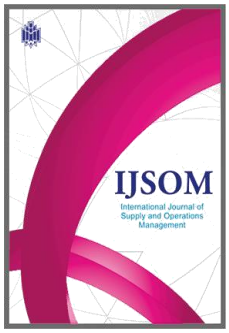

The Selective Study of a Closed-Loop Supply Chain by a Socially Responsible Prospective

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Abstract

Improving the economic and environmental performance has become the main interest of the businesses to get the sustainability in touch in the long time. As a result of environmentally activities and reduction of resources for economic life, many companies use the reverse and the forward supply chain incorporation together; thus, in the present century the major challenge facing businesses is the needs of consumers and shareholders. Indeed, organization's awareness of their responsibility has been addressed in a new concept called corporate social responsibility. The main question that arises is that How we can affect our closed-loop supply chain by considering social responsibility. For this purpose, in the following sections, we sort and compare 30 gathered papers from 2004 to 2019 by the term closed-loop supply chain in a table and investigate the term corporate social responsibility in these studies and present the analyzed results.

Keywords: Corporate Social Responsibility; Closed-Loop Supply Chain; Stackelberg Game.

1. Introduction

Nowadays, it is not the manufacturers and their products that compete with each other, but the competition makes sense in the chains that leads to product production, distribution, sales, etc. (Chopra and Meindl (2006)). The global economy considers competitiveness as the ability of the national economy to sustain, grow or maintain a standard of living on a per capita earning.

Nowadays in the competitive markets of the world, activities such as supply and demand planning, materials procurement, producing and product planning, commodity maintenance, inventory control, distribution, delivery and customer services that are already being performed at company level, has shifted to the supply chain level. Improving the economic and environmental performance has become the main interest of the businesses to get the sustainability in touch in the long time.

Originally, the increasing focus to reverse chains and closed loop supply chain problems started with public consciousness (Dowlatshahi S. (2000)). In order to maximize the economic or in other word environmental value of the supply chain, a two-way communication called closed loop supply chain was established between the forward and reverse chains (Sundari, and Vijayalakshmi (2016)). The integration of forward and reverse chains makes it possible to recover a remaining value of the used products (Atasu, Guide and Van Wassenhove (2008)).

In recent times, increasing concentration goes to closed-loop supply chain due to increasing environmental issues, government regulations, the limitation of natural resources and the impact of the green laws (Bashiri and Shiri (2015)). So, many companies use the reverse and forward supply chain besides each other for collecting the used products and returning them back to the production cycle. Consumer referrals occur during the product's lifetime or at the end of use or life. Each type of referral requires a different process and has a potentially distinctive and significant effect on activities of forward supply chain (Guide, Harrison and Van wassenhove, (2003)).

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The concept of closed-loop is more extensive than returns management and encompasses three main subjects (Defee Clifford et.al (2009)): returns management, product acquisition and asset recovery (Fleischmann et. al. (2000), Krikke (1998), Mollenkopf and Closs (2005), Saghir and Jonson(2001),Thierry(1995)), issues of remanufacturing (Guide(2000), Guide et.al.(2001), Jayaraman et. al. (1999), Van der Laan(1999)), Secondary markets and channel design (Fleischmann et. al. (2000), Fuller et. al. (1996))

In addition, the major challenge facing businesses this century is the needs of consumers and shareholders. Indeed, organization's awareness of their responsibility has been addressed in the context of corporate social responsibility (CSR).

Corporate social responsibility is a broad term with numerous semantic changes (Mohr et. al. (2001)). The development of the modern understanding of CSR as a definitive structure is varied and can be traced back to the 1930s with the onset of social responsibility in the private sector. However, in the 1950s, the first academic definition of corporate social responsibility was explained by Bowen (1953) that the social responsibility of business managers is to make decisions due to the society's values (Andrés et. al. (2019)).

Corporate strong attention to CSR has not been thoroughly to their liking. Many companies have been informed of their social responsibilities after being amazed by public concerns about issues they had not previously thought to be part of their business responsibilities. Nike, for example, when media outlets reported abusive labor practices in the early 1990s, faced a vast consumer boycott.

In Shell Oil's decision to sink an outdated oil rig, led to protests in 1995. Pharmaceutical companies discovered that they were expected to respond to the AIDS pandemic in Africa.

Debates over CSR found enough importance and were being focus of negotiations in corporate boardrooms. In 2005, 360 different CSR related shareholder resolutions were launched on different issues like labor conditions to global warming (Porter and Kramer (2006)).

As we mentioned above, we face with a question: How closed-loop supply chain is affected by social responsibility of businesses?

For this purpose, the present paper focused on journals with papers which were more relevant to our issue and this helped us to be able to compare them in a more efficient way to reach the clear results with more details. Although a lot of papers have dealt with closed-loop supply chain, there were few papers that directly worked on socially responsible closed chain with concept of what was intended. Hence, we chose and collected 30 papers from 2004 to 2019 (we can see list of journals in table 1) by the term closed-loop supply chain, and investigated them to see whether they have pointed out CSR or not, and in case they have used the term CSR, how it is mentioned.

In the following sections, we sort and compare the journals in a targeted table and analyze the results.

Table 1. List of Journals.

journal	Number of papers
International Journal of Production Economics	9
Journal of Cleaner Production	7
International Journal of Production Research	4
Sustainability	3
Management Science	2
Journal of Manufacturing Systems	2
European Journal of Industrial Engineering	1
International Journal of Management Science and Engineering Management	1
IEEE Transactions on Engineering Management	1
Total	30

2. Literature Review

Review papers have crucial role in analyzing, comparing and categorizing the past, current, and future trends in a field of science. We can find comprehensive papers in every aspect of closed-loop supply chain. Here we would review the selected papers to understand more about performed studies.

Here the suitable reverse channel structure is chosen for the customer used product's collection.

R. Canan Savaskan et al (2004) consider three different scenarios for collection process in a closed chain: 1. collecting directly by manufacturer, 2. collecting by existing retailer through suitable incentives, 3. collecting by a third party. The three scenarios are modeled as decentralized systems by the manufacturer-led the Stackelberg game. The findings show that the retailer who is the closest agent to the customer is the most influential member of closed loop supply chain for collecting activity.

R. Canan Savaskan Luk N. Van Wassenhovev (2006) focuses on the reaction between the reverse and the forward channel choice respectively to collect used product and to decide about pricing strategy in a closed loop supply chain by competitive retailing. To this end, the used product is collected by the manufacturer in a direct collection and the retailers work as a product return point in an indirect collection system. First, this matter is examined that how the appropriation of collection to retailers influences their market strategic behavior and then it considers the economic dealings which is experienced by the manufacturer while considering an optimal structure of the reverse channel. Through a direct collection channel, the profits are influenced by the returns scale effect on collection effort, while the profits are influenced by the competitive reaction of retailers in the indirect channel. Then they show that the payments as a buy back price transferred to the retailers provide the flexibility of a wholesale price that can be used to price Distinguish between the different profitability retailers.

Min Huang et. al (2013) investigate optimal decisions in a closed chain which has two channels for recycling process. The products are sold by manufacturer through retailer channel while the collection activity is done competitively by the retailer and the third party. According to game theory, the decisions about pricing and the strategies of recycling, as the function of supply chain, are characterized for the centralized and the decentralized Stackelberg game models. By comparison this study with available optimal decisions of the closed chain and the retailer recycling channel or the third-party recycling channel respectively from the manufacturer viewpoint and the consumers' viewpoint the closed chain with two recycling channel performs better than the closed chain with single recycling channel. Furthermore, at the end some suggestions that would give the main social value to the macro control are being offered.

Tsan-Ming Choi et al (2013) and T. Maiti & B.C. Giri (2015) studied one centralized and also three decentralized supply chain models consisting of a manufacturer, a retailer and a third party through Stackelberg game, and under leadership of every member of the chain. T. Maiti & B.C. Giri (2015) additionally used Nash equilibrium to solve these models. To find the best scenario in both papers optimum results were compared and for this purpose numerical analysis were used. The results of systematic comparison in both papers show that retailer Leadership model is the most useful.

Chia-Hung Chuang et al (2014) study high-tech product's closed loop supply chain models that is highlighted with a short cycle of life and unstable demand. Three different ways of collecting used products in reverse chain are observed: directly collection by the manufacturer, collection by the retailer, sub-contraction to a third party. Under three different reverse structures, the optimal quantities of manufacturer's product and profits are characterized and compared. Also, the collection cost structure's effect and law execution of product take back on the choice of manufacturer for reverse chains are shown.

Xianpei Hong et al (2015) and Peng Ma et al (2017) investigate closed-loop supply chains in one centralized and three decentralized models under Stackelberg game through manufacturer leadership by considering different situations: manufacturer- led collection model, retailer- led collection model and third party- led collection model.

Xianpei Hong et al (2015) explore the optimal decisions about advertisement, collection and pricing of used product. Analytically, it is shown that decisions about pricing, collecting and profits are strongly influenced by advertising. Moreover, the optimal decision for manufacturer is to subcontract the retailer for collecting process. Also, it is found that cooperative advertising might not coordinate the closed chain, but a tariff contract might correlate the members of the decentralized closed chain by similar performance as in a centralized closed chain.

Peng ma et al (2017) as well as chain profitability provide the optimal rate of marketing effort collection and pricing decisions. Then the base models are investigated along two directions: incorporating retailer's distributional fairness concerns into the manufacturer collection model, and considering potential recycle cost advantages by retailer and third party, in comparison to the manufacturer collection model.

S. Panda et al (2016) deal with coordination and profit sharing in a socially responsible supply chain through maximizing profit and showing social responsibility by recycling and also a discount contract to improve conflict of channel. results show that in decentralized models, when the CSR and channel do not perform in parallel, one member’s motive for maximizing perfect welfare is seemed to be enough for channel coordination and also the channel experiences the best performance. On the other hand, if the CSR is aligned with the channel, channel conflict cannot be tackled. moreover, no difference which member is perfect welfare maximizer and which is socially responsible, the quantity discount contracts can curb the channel conflicts. If the retailer is responsible for the CSR, the wholesale price outweighs the marginal cost of production in discount contract, whereas, if the model contains socially responsible manufacturer, the result is reverse.

Also, if a heavy weight is put on CSR, the manufacturer's pure profit might be negative. In addition, CSR and total profit are directly relevant while it is inversely related to a manufacturer's pure profit. Finally, the bargaining result reveals that when the same intensity is put on CSR closed chain members always prefer others to have corporately socially responsibility by the prospective of pure profit.

S. Saha et al (2016) investigate a reward-based policy to collect used products for remanufacturing. The manufacturer in a forward chain, the manufacturer sells products to customers through retailing channel and in reverse chain three different ways of collection are used to collect used products: direct collection by the manufacturer, indirect collection by the retailer or by a third party. Mathematical models are developed for non-cooperative and centralized scenarios. To characterize the remanufacturing strategies and the pricing decisions that show individual and overall performance under the proposed theory, Optimality of all the models is examined. To achieve a beneficial result for members of the channel a three-way discount mechanism is proposed for the manufacturer.

Xiaohua Han et al (2017) research manufacturer's reverse channel choice in a closed chain with one dominant retailer with uncertainty and disruption remanufacturing cost. Results show that on profitability, the direct channel outperforms indirect channel under a favorable operational environment, while the indirect channel performs better in an adverse way. Also, it is found that the indirect channel had higher robustness than the direct channel under remanufacturing risks.

Juhong Gao et al (2016) investigate the impact of various structures of the channel on the performances of a closed chain and the optimal decisions with demand dependent to the price and effort, so as to determine the structure with most profit and to present strategy of coordination for the decentralized closed chain. Considering the impression of demand expansion on collecting and selling effort CLSC game theory models are designed as centralized and decentralized models, in order to inquire optimal decisions for collecting and selling effort and pricing under various structures namely vertical Nash, manufacturer and retailer led Stackelberg games. The findings indicate that by changing dominant member from the manufacturer to the retailer, there is always improvement for the retailer and when there is a large demand expansion effectiveness for collecting effort also the manufacturer may profit. when there is a low demand expansion effectiveness for collecting effort, the most desirable power structure prepares for consumers and the closed chain. Otherwise, the closed chain with retailer led is the most profitable. Furthermore, the offered strategy named low price promotion might effectively develop the decentralized structure performance.

Xiaohua Han et al (2016) study a closed chain with one dominant manufacturer and one retailer to investigate the channel decisions about collection and production from the perspective of profitability and robustness of the system. It is found that in the absence of disruption, the collection channel called indirect channel obtains more. However, in the existence of disruption, the collection channel called direct channel is more robust and provides more profits for manufacturer, when there is large positive disruption. Also, it is found that for coordinating closed chain members, the revenue-sharing contracts are influential.

T. Maiti and B. C. Giri (2017)consider a closed chain with two level and two recycling channels. The product demand is linearly related to quality of product and selling price. The retail price and the wholesale price are controlled respectively through a variable markup and a fixed markup. The used product which is sold through forward channel for the first time, is collected directly by the retailer and by an exchange suggestion and part of the collected items is replaced with new ones. The presented model is analyzed under four different structures: Nash game, dominant manufacture and dominant retailer Stackelberg games and cooperative game. Also, the cooperative game's feasibility is examined by means of a bargaining model. A sensitivity analysis is performed to examine the effects of main parameters on the closed chain decisions.

Shibaji Panda et al (2017)in a paper entitled "Coordinating a socially responsible closed loop supply chain with product recycling" consider maximization of the profit and corporate social responsibility to explore coordination in a closed chain and to analyze the impact of social responsibility. The manufacturer shows his social responsibility by recycling the collected used products by the retailer. The results show that the non-profit maximizing motive through social responsibility provides higher profit margin. Recycling variation lead to change negative wholesale price. So, recycling is a main parameter for determining the wholesale price and also manufacturer pure profit. Therefore, there should be a recycling limitation to benefit optimally. To achieve the optimal performance, the manufacturer gives all generated revenues through recycling namely reward to the retailer. Thus, corporate social responsibility is absolutely an expensive activity for the manufacturer although the pure profit maximizing supply chain CSR can change surplus profit share.

Shu-San Gan et al (2017)develop a model for products with short cycle of life based on pricing decision in closed loop with three main members: manufacturer, retailer and third party as collectors. The retailer sells the new products and the manufacturer sells the remanufactured product directly. Two scaling factors are suggested in the model acceptance of customer and preference of customer. For purchasing a remanufactured product by comparison to the joint sell channel

applying a distinct channel might increase the total profit of the supply chain. The findings show that the member's profits and pricing decisions are influence by the two suggested factors.

Yanting Huang and Zongjun Wang (2017) investigate disruption of cost in a closed loop supply chain where used items are gathered respectively through the online channel and by the third party through the offline recycling channel. Stackelberg game method is applied to achieve equilibrium decisions about dual and single channel of recycling and to examine effect of cost disruption on strategies of production and collection. It is shown that disruption of new product's cost has a positive effect and the disruption of remanufacturing product's cost has a negative effect on Collection quantity and negative disruptions of new and remanufactured product's cost can be gainful for the manufacturer. About the manufacturer's channel choice, with the existence of new product cost positive disruption, the dual recycling channel overcomes single recycling channels cause the manufacturer acts in two different positions buyer and a collector competitor and also can control the best acquisition price and transfer price for coordinating both the online and offline recycling channel. While with the existence of new cost negative disruption, if the large negative disruption happens for the remanufacturing cost, manufacturer chooses the dual channel.

Liwen Liu et al (2017)study a closed chain to investigate the decisions about pricing and reverse chain where the new and remanufactured products are sold by means of single retailer and collected by dual recycling channels. There are three alternatives due to existed competition between the dual recycling channels and the manufacturer for collection process: the manufacturer and retailer, the retailer and third party, the manufacturer and third-party dual collecting channel. Analytically it is shown that the optimal values ranking between the three alternatives are independent of the competition intensity regardless of the competition intensity the best manufacturer choice is the manufacturer and retailer dual collecting channel

Ata A. Taleizadeh et al (2017)propose a model to research optimization price and effort decisions, quality and policies about return way regard to the effect of reference price in a supply chain with three level. By considering different structures of channel power for investigation the effect of distinct scenarios on optimal decisions and closed chain's five distinct structures of channel power are addressed: centralized, vertical Nash, Stackelberg game scenarios with dominant manufacturer, retailer and third-party. A numerical example is provided to show the expanded model theoretical results also to diagnose the best structures of channel power the optimal decisions are compared. Then a sensitivity analysis is carried out to examine the impact of the main parameters on the model's behavior.

Jing Zhao et al (2017)design a closed loop where the dual collecting channels are applied for recycling the collected used items. In order to examine the channel decisions two models are presented. By attention to the competition in collection channel and analytical solutions of these two models, findings of the study leas to some new insights such as: 1.retailer engagement in collection process is the best for the manufacturer regardless of collecting channel's type(single or dual) , 2. to grow environmental performance and quantity of collected products the best option for manufacturer is applying dual collecting channels, 3. although the existed competition intensity in the dual collecting channels influence on the channel optimal prices(wholesale and retail) it has no effect on the order of the whole chain optimal collection effort.

B. C. Giri et al. (2017)design a closed chain with dual forward (retail and e-tail) and dual reverse (third party and e-tail) channel. Five different scenarios are employed to derive the pricing and collected product decisions: centralized, Nash game, Stackelberg scenarios through leadership of manufacturer, retailer and third-party. The numerical study shows that the decentralized scenario which is led by the retailer benefits more.

Nikunja Mohan Modak et al (2018)apply a two-level closed chain with demand dependent to price and level of quality to analyze the impacts of recycling and quality on decision related to the pricing. Three collection process for recycling are considered under collection-led via retailer, manufacturer and third-party. The results show that in any case, third-party's participation in collecting is unfavorable. To determine the best structure, key parameters of the introduced model are cost parameters in the reverse channel. The quality level and product price have the same variation with recycling. The collection effort limitation determines which member might prepare the best quality by lowest price, manufacturer or retailer. The sub game perfect equilibrium and alternative proposed bargaining strategy are employed to cut down channel conflict and to divide surplus profit. The analysis result shows that the sub game perfect equilibrium retail price reduce channel conflict and depicts particular profit split regardless to the proposed member.

B.C. Giri et al. (2018) present two game theoretic models in a two-echelon closed chain, in which the demand in the first model is dependent to price of selling and warranty time and in the second model in addition to parameters in the first one, is also dependent to greening level. In manufacturer proposed warranty time, part of collected products is refurbished and return to the customer and the residual part is remanufactured and is sold through the secondary market, then the same part is exchanged by the new items. Under the described condition, different scenarios are defined: Centralized, decentralized scenario by dominant manufacturer, and revenue sharing contract. Analytical and numerical analyses show

that due to the chain main decisions, second model have better performance in comparison to the first model. Higher greening level and warranty time is belonged to centralized model in comparison to decentralized model.

To answer the question" from the aspect of economic, environment and social responsibility, which agent is the best remanufacturer, third-party or supplier?" Wei Yan et al (2018)design two models in which main manufacturer have two options for remanufacturing process: outsourcing to a third party or to a supplier. Results show that the first model set up more sustainable economic, social and environmental conditions but the supplier in second model, do not support this strategy. Then, a revenue sharing contract is offered to develop three-way win result that support all considered aspects economic, social and environmental for all members of chain and also incorporated into the second model.

Ata Allah Taleizadeh et al (2018) apply two different closed chains to explore the pricing strategies the level of quality and effort decisions: 1. single forward channel with two recycling channel and 2. Two forward channel with two recycling channels. To obtain the optimal prices, quality levels, sales and collection efforts under these two structures of the channel two manufacturer-led Stackelberg games are designed. Besides presenting new insights, equilibrium solutions are specified and compared and the most benefited structure is investigated. Coordination mechanism is proposed to decrease the conflict of the channel and grow the profit for each member. The results show that the manufacturer benefits more from the second model and the retailer's optimal structure. However, by employing a coordination mechanism all members benefit from the online selling channel in addition the results reveal that the quality level in the second model is always greater than the first model. Moreover, the sensitivity analysis show that the recycling channel member with the greatest market share exerts greater collections effort and propose lower buyback prices than other members.

Hao Zou et al (2018) employ a sustainable closed chain with two price-competitors(retailers) and to examine the coordination mechanism the two-way risk aversion is considered. Under centralized and decentralized game theories scenarios, optimal wholesale, retail, and recycling prices are investigated. Examining the risk aversion coefficient's effects on optimal decisions show that the risk aversion coefficients about the manufacturer and retailer have similar effects in a centralized scenario and have different impacts in a decentralized scenario on the wholesale, retail, and recycling prices. Under the comparison between two scenarios, findings show that in the centralized scenario the wholesale price and recovery price are higher. For closed chain coordination, this study offers a revenue-sharing contract that was shown by coordinating price competition with risk aversion, and examine limitation of parameters that influenced the revenue-sharing contract. By determining the optimal ratio of revenue-sharing, the offered contract can improve the profits of members.

Nengmin Wang et al (2019) consider a competitive closed chain in terms of collectors in recycling market and of new and remanufactured products market. Three Stackelberg scenarios are designed competitively. In the first scenario manufacturer does not present a closed chain completely and the whole recycling business is taken by the remanufacturer while in the second one, the manufacturer take the collection process by its own and there is competition between the manufacturer and remanufacturer in the recycling market and lastly the third scenario argues about the manufacturer who subcontracts the collection process to the retailer and in the recycling market there is competition between the manufacturer and the retailer. To study the strategies of optimal pricing Stackelberg game model is employed and also numerical analysis represented. The findings are generated from three sides as follows: the recycling choice of manufacturer controls ability of the chain and effect on retailers and remanufacturers. Findings indicates that the manufacturer will prefer recycling and remanufacturing used products and the strategy of collecting outsourcing leads to retailer's more interest to make the price less any way the remanufacturer prefer the manufacturer for collecting and considering the pricing strategies control ability and predictability however the manufacturer also is interested in recycling itself.

Kunpeng Li et al (2019) design a supply chain in which the leader of the Stackelberg game, manufacturer involves in process of remanufacturing to benefit from savings of production cost. The used products collection is taken by manufacturer or by retailer. Extended warranty as the after sales service is proposed and is sold individually by the manufacturer or the retailer. To answer the main question of the research" How do remanufacturing process and after sales service have an effect on decisions of channel selection decisions " game theoretic models are used. The advantages of shared deciding in terms of efficiency of remanufacturing process efficiency and performance of after sales service are explored in this paper. It is found that the retailer benefits from collection of used products and from proposing the after-sale service cause at the same time the retailer can decide about remanufacturing process and after sales service and consequently cuts down he supply chain double marginalization. Also, it is demonstrated numerically how the decisions about selecting channel is affected by the used products collecting costs and presenting after sales service.

Yunzhi Liu and Tiaojun Xiao (2018) investigate the decisions about the pricing and collecting rate and structure of reverse channel strategy for a closed chain with corporate social responsibility and green consumers. The most important feature of this closed chain is the environmental responsibility roles of manufacturer and consumers. The collecting undertaker is chosen by the manufacturer decision. Generally, five results are observed. First of all, increasing the collection price rate of

retailer and quantity of sales may lead to increase the degree of environmental responsibility at the same time. Second, managing the collection by the manufacturer in comparison to retailer lead to a lower retail price, higher rate of collection or sales quantity. Third, when the collection effectiveness by retailer is lower than the manufacturer, the centralized model take more advantage of manufacturer managed collection. Moreover, when the collection effectiveness by retailer is relatively low, the manufacturer or the supply chain take more advantage of manufacturer-led collection. And finally, the social welfare by manufacturer led collection can be higher than the retailer led collection in the decentralized model.

Nana Wan and Dingjun Hong (2019) examine the optimal strategies about pricing and recycling in a closed chain with dual collection channel through Stackelberg game scenarios. The manufacturer pays the either uniform or different transfer prices to retailer and third-party as collectors and also either the manufacturer or the recyclers provide government subsidy the subsidy's effects and transfer pricing policies are explored from three different point of view, the customers, the environment and chain members. Through the systematic comparisons and numerical examples, the findings point that employing remanufacturing or recycling subsidy leads to consumption stimulation recovery increase more profit generation for closed chain members. Moreover, the manufacturer, the retailer and the customer benefited from paying different transfer prices to the recyclers however the third party and the environment benefited from paying uniform transfer prices by considering manufacturer leadership in Stackelberg game the closed chain has more inclination to apply product's collection through paying different transfer prices to two recyclers. At last the influence of subsidy policies on the retail price the total rate of collection and the performance of closed chain is related to the subsidy's size and unrelated to the subsidy's type.

As you see, all gathered information from investigation of pointed papers present in table 2:

Table 2. Classification of the studied papers

Cases number	reference	Process*	models	Collection channel**		Stackelberg leader	Nash game	Competition	Consumer surplus	CSR
				Single channel	Double channel					
1	Savaskan et al. (2004)	1	a,b,e,h	M-R-T		M				
2	Savaskan and Van Wassenhove (2006)	1	k,l,n,p,q	M	R1, R2	M		*		
3	Min Huang et al. (2013)	2	a,j		R, T	M		*		
4	Choi et al. (2013)	1	a,h	T		M-R-T				
5	Chuang et al. (2014)	1	a,b,e,h	M-R-T		M				
6	T. Maiti and B.C. Giri (2015)	1	a,h	T		M-R-T	*			
7	Hong et al. (2015)	1	a,b,e,h	M-R-T		M				
8	S. Panda et al. (2016)	1	a,b,e	M-R		M			*	*
9	S. Saha et al. (2016)	1	a,c,f,i	M-R-T		M				
10	Xiaohua Han et al. (2016)	1	b,e	M-R		R				
11	Gao et al. (2016)	1	a,b	M		M-R	*			
12	Xiaohua Han et al. (2017)	1	a,b,e	M-R		M				
13	T. Maiti, B.C. Giri (2017)	1	a,e	R		M-R	*			
14	S Panda et al. (2017)	2	a,e	R		M	*		*	*
15	Shu-San Gan et al. (2017)	1	i	T		M				
16	Huang and Wang (2017)	2	r,s,t	M-T	M, T	M		*		

Table 2. Continued

Cases number	reference	process	models	Collection channel		Stackelberg leader	Nash game	competition	Consumer surplus	CSR
				Single channel	Double channel					
17	Liwen Liu et al. (2017)	1	d,g,j		M, R-M, T-R, T	M		*		
18	Taleizadeh et al. (2017)	2	a,h	T		M-R-T	*			
19	Jing Zhao et al. (2017)	2	d,g		M, R-M, T	M		*		
20	B.C. Giri et al. (2017)	2	a,m		M, T	M-R-T	*			
21	Peng Ma et al. (2017)	1	a,b,e,h	M-R-T		M				
22	Mohan Modak et al. (2018)	2	b,e,h	M-R-T		M				
23	B.C. Giri et al. (2018)	1,3	a,c	M		M				
24	Wei Yan et al. (2018)	1	y,z	T-S		M-T		*	*	*
25	Taleizadeh et al. (2018)	2	j,u		R, T	M		*		
26	Hao Zou et al. (2018)	1,2	a,o		M, R1, R2	M		*		
27	Wang et al. (2019)	1	v,w,x	T	M, T-R, T	M		*		
28	Kunpeng Li et al. (2019)	1	a,b,e	M-R		M				
29	Liu and Xiao (2019)	1	a,b,e	M-R		M	*		*	*
30	Wan and Hong (2019)	1,2	j		R,T	M				

*Numbers in this column shows processes in reverse chain: 1. remanufacturing, 2. recycling, 3. refurbishing.

**The used abbreviations are as follows: M: manufacturer, R: retailer, T: third party, S: supplier. Also, the comma shows the members in a joint chain but dash separates the models completely.

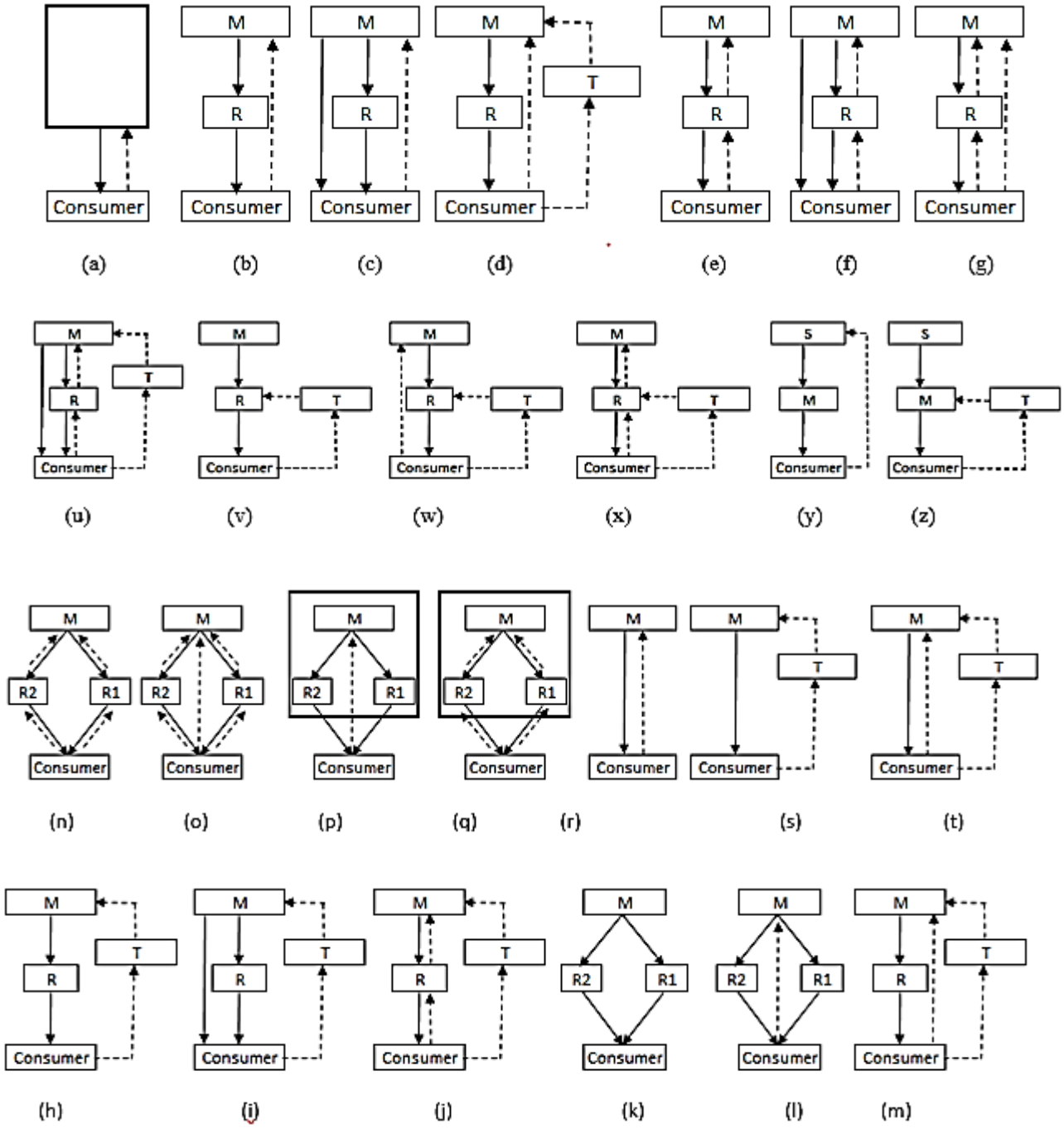

Figure 1. Models related to the classification of literature review in Table 1

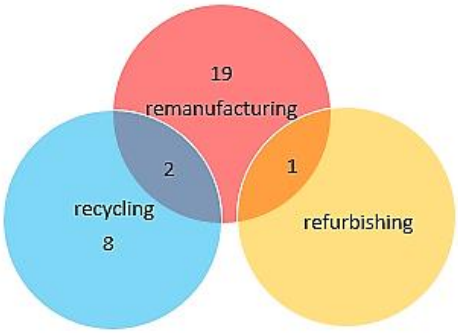

Figure 2. process separation

About the structures, it shows that 19 papers consider centralized model and also use it to compare with decentralized one. And then models 2 and 5 are the most popular.

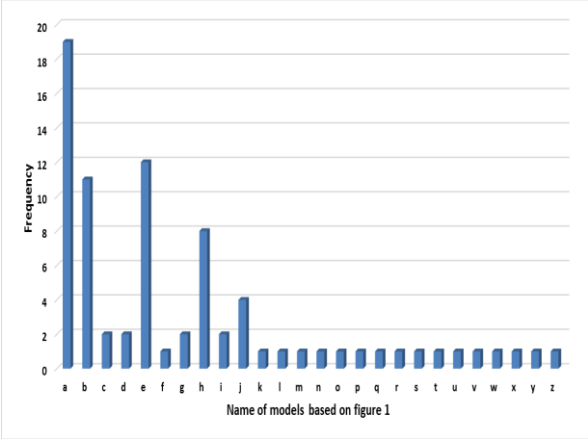

Figure 3. Bar chart about used models

4. Discussion

All gathered information above show us there are lots of research gaps that we can investigate and work on for future studies. In this section we aim to identify these research gaps that have been overlooked in the collected papers:

- In most presented cases all processes of producing through used products are considered as one joint process mainly remanufacturing and recycling and just three papers (refer to rows 23,26,30 in table 2) focus on two different processes, remanufacturing and refurbishing, remanufacturing and recycling. To have more real observation, process separation could be considered based on the introduced product. For instance, we can consider remanufacturing, recycling and refurbishing together and then regarding to the quality of used products propel them in to the appropriate process.
- The part of the collected products is not qualified enough to restore and this debris can have great impact on environmental pollution. hence, applying processes such as landfilling can curb the negative effects on the environment.
- CSR is not just relevant to manufacturer, green consumers as an effective environmental factor in a closed chain should not be neglected. Results show that just in one case green consumers are introduced (refer to row 30 in table 2). Also, other members of the chain can be socially responsible.

- Some cases merely use models with single collection channel, or some merely use double collection channel and just in two cases we have both single and double collected channels (refer to rows 2 and 27 in table 2). For achieving a comprehensive sight, it is suggested to compare single and double collection channels simultaneously.
- In most papers collected items are considered as a rate which is percentage of produced products. Only in one paper, return items are considered as a function and exhibits quantity of returned items in competitiveness models. Introducing function is more beneficial as we can investigate and control the influential parameters on return rate.
- In some models, supplier is considered as a chain member but retailer is not (refer to row 24 in table 2). Considering all members is helpful in making decision.

Thus, regarding the above gaps, the new model can be mentioned which has comprehensive view.

These days the CSR concept is not just dedicated to producing a product based on consumer's expectations and it is also referred to all members of the closed-loop supply chain. So, considering a closed-loop supply chain with one manufacturer, one retailer, one third party, consumers as decentralized models and one centralized model that all mentioned members try to show their social responsibilities by doing different activities is more real and also reasonable.

In simple decentralized models the collected channel is single and no competitive is existed. The manufacturer is responsible for remanufacturing and recycling processes; and retailer is responsible for refurbishing process; member of chain who is responsible for collecting used items (here can be manufacturer, retailer or third party separately in three different models) also is responsible for separating collected items according to quality of them for delivering them to other members in return for a fee and show his CSR activity by qualitative separation and landfilling the useless items. Caring about processes is a way of showing CSR.

In competitive decentralized models, manufacturer is responsible for remanufacturing, recycling and landfilling processes and retailer for refurbishing process.

Also, members of chain who are responsible for collecting used items (here manufacturer and retailer or manufacturer and third party or retailer and third party) also are responsible for separating collected items regard to quality of them for delivering them to other members in return for a fee and also show part of their CSR activity by qualitative separation.

In order to able for real judgment and comparison and also to get a real result that can be operationalized we consider consumers in two parts. One part does not have social responsibility cause lack of awareness. The other part is aware of social responsibility and is introduced in two parts, too. One part should be paid to show CSR and the other show CSR freely and voluntarily. And this closed-loop is repeated again.

We can also change the type of activity based on the type of produced products. Moreover, dividing duties such as recycling, refurbishing, landfilling and remanufacturing can be in a different way which is more beneficial for the whole chain.

References

Andrés, Mauricio, Agudelo L., Jóhannsdóttir L., and Davídsdóttir B. (2019). A Literature Review of the History and Evolution of Corporate Social Responsibility. *International Journal of Corporate Social Responsibility*, Vol. 4(1), pp. 1-23.

Atasu A., Guide Jr V.D.R., and Van Wassenhove L.N. (2008). Product reuse economics in closed-loop supply chain research. *Production and Operations Management*, Vol. 17(5), pp. 483-496.

Bashiri M., and Shiri M. (2015). Design of closed-loop supply chain network with considering of multi-part collection centers under uncertainty with two heuristic and meta-heuristic algorithms. *Industrial Engineering Research in Production Systems*, Vol. 3(5), pp. 27-41.

Choi, TM., Li, Y., and Xu, L. (2013). Channel leadership, performance and coordination in closed loop supply chains. Intern. *Journal of Production Economics*, Vol. 146(1), pp. 371–380.

Chopra V.S., and Meindl P. (2006). Supply Chain Management . Strategy , Planning & Operation. Prentice Hall – 552 Seiten (3. Auflage 2006), ISBN: 0-1317-3042.

Chuang, C., Wang, C. X., and Zhao, Y. (2014). Closed-loop supply chain models for a high-tech product under alternative reverse channel and collection cost structures. *International Journal of Production Economics*, Vol. 156, pp. 108–123.

Defee, Clifford C., Esper T., and Mollenkopf D. (2009). Leveraging Closed-Loop Orientation and Leadership for Environmental Sustainability. *Supply Chain Management*, Vol. 14(2), pp. 87-98.

Dowlatshahi S. (2000). Developing a Theory of Reverse Logistics. *Interfaces*, Vol. 30(3), pp.143-155.

Fleischmann, M., Beullens, P., Bloemhof-Ruwaard, J.M., and Wassenhove, L.N.V. (2000). The impact of product recovery on logistics network design. *Production And Operations Management*. Vol. 10(2),pp. 156-173.

Fleischmann, M., Krikke, HR., Dekker, R., and Flapper, S.D.P. (2000). A characterisation of logistics networks for product recovery. *Omega-International Journal of Management Science*. Vol. 28(6),pp. 653-666.

Fuller, D.A., Allen, J., and Glaser, M. (1996). Materials recycling and reverse channel networks: the public policy challenge. *Journal of Macromarketing*, Vol. 16(1), pp. 52-72.

Gan, SS., Pujawan, I. N., Suparno., and Widodo, B. (2017). Pricing decision for new and remanufactured product in a closed-loop supply chain with separate sales-channel. *International Journal of Production Economics*. Vol. 190, pp. 120-132.

Gao, J., Han, H., Hou, L., and Wang, H. (2016). Pricing and effort decisions in a closed-loop supply chain under different channel power structures. *Journal of Cleaner Production*. Vol. 112, pp. 2043-2057.

Giri, B. C., Chakraborty, A., and Maiti, T. (2017). Pricing and return product collection decisions in a closed-loop supply chain with dual-channel in both forward and reverse logistics. *Journal of Manufacturing Systems*. Vol. 42,pp. 104-123.

Giri, B. C., Mondal, C., and Maiti, T. (2018). Analysing a closed-loop supply chain with selling price, warranty period and green sensitive consumer demand under revenue sharing contract. *Journal of Cleaner Production*. Vol. 190, pp. 822-837.

Guide, VDR., Harrison, TP., and Van wassenhove, LN. (2003). The challenge of closed-loop supply chains. *Interfaces*, Vol. 33(6), pp. 3-6.

Guide V.D.R. (2000). Production planning and control for remanufacturing: industry practice and research needs. *Journal of Operations Management*. Vol. 18(4), pp. 467-483.

Guide, VDR., and Van Wassenhove, LN. (2001). Managing product returns for remanufacturing. *Production and Operations Management*, Vol.10(2),pp. 142-155.

Hong, X., Xu, L., Du, P., and Wang, W. (2015). Joint advertising, pricing and collection decisions in a closed-loop supply chain. *International Journal of Production Economics*, Vol. 167, pp. 12-22.

Han, X., Wu, H., and Yang, Q. (2016). Reverse channel selection under remanufacturing risks: Balancing profitability and robustness. *International Journal of Production Economics*. Vol. 182, pp. 63-72.

Han, X., Wu, Haiyan., Yang, Qianxia., and Shang, J. (2017). Collection channel and production decisions in a closed-loop supply chain with remanufacturing cost disruption. *International Journal of Production Research*, Vol. 55(4), pp. 1147-1167.

Huang, M., Song, M., L, L., and Ki, W. (2013). Analysis for strategy of closed-loop supply chain with dual recycling channel. *International Journal of Production Economics*, Vol. 144(2), pp. 510–520.

Huang, Y., Wang, Z. (2017). Dual-Recycling Channel Decision in a Closed-Loop Supply Chain with Cost Disruptions. *Sustainability*, Vol. 9(11).

Jayaraman, V., Guide, VDR., and Srivastava, R. (1999). A closed-loop logistics model for remanufacturing. *Journal of The Operational Research Society*. Vol. 50(5), pp. 497-508.

Krikke, H.R., VanHarten, A. and Schuur, P.C. (1998). On a medium term product recovery and disposal strategy for durable assembly products. *International Journal of Production Research*, Vol. 36(1), pp. 111-40.

Liu, L., Wang, Z., Xu, L., Hong, X., and Govindan, K. (2017). Collection effort and reverse channel choices in a closed-loop supply chain. *Journal of Cleaner Production*, Vol. 144, pp. 492-500.

Li, K., Li, Y., Gu, Q., and Ingersoll, A.(2019). Joint effects of remanufacturing channel design and after-sales service pricing: an analytical study. *International Journal of Production Research*. Vol. 57(4), pp. 1066-1081.

Liu, Y., and Xiao, T. (2018). Pricing and Collection Rate Decisions and Reverse Channel Choice in a Socially Responsible Supply Chain With Green Consumers. *IEEE Transactions on Engineering Management*, pp. 1–13.

Ma, P., Li, Kevin W., and Wang, Z. (2017). Pricing decisions in closed-loop supply chains with marketing effort and fairness concerns. *International Journal of Production Research*. Vol. 55(22), pp. 6710-6731.

Maiti, T., and Giri, B. C. (2015). A closed loop supply chain under retail price and product quality dependent demand. *Journal of Manufacturing Systems*, Vol. 37(SI), pp. 624–637.

Maiti, T., and Giri, B. C. (2017). Two-way product recovery in a closed-loop supply chain with variable markup under price and quality dependent demand. *International Journal of Production Economics*, Vol. 183, pp. 259-272.

Mohr L.A., Webb D.J., and Harris K.E. (2001). Do consumers expect companies to be socially responsible? The impact of corporate social responsibility on buying behavior. The Journal of Consumer Affairs,35(1), pp. 45-72.

Mollenkopf, D. and Closs, D.J. (2005). The hidden value in reverse logistics. *Supply Chain Management Review*, pp.34-43.

Modak, N. M., Modak, N., Panda, S., and Sana, S. S. (2018). Analyzing structure of two-echelon closed-loop supply chain for pricing, quality and recycling management. *Journal of Cleaner Production*, Vol. 171, pp. 512-528.

Panda, S., Modak, N. M., and Pradhan, D. (2016). Corporate social responsibility,channel coordination and profit division in a two-echelon supply chain. *International Journal of Management Science and Engineering*. Vol. 11(1), pp. 22–33.

Panda, S., Modak, N.M., Eduardo Cardenas-Barron, L. (2017). Coordinating a socially responsible closed-loop supply chain with product recycling. *International Journal of Production Economics*, Vol. 188 , pp. 11-21.

Porter M.E., Kramer M.R. (2006). *Strategy and Society: The Link Between Competitive Advantage and Corporate Social Responsibility*. Vol. 84(12) , pp. 78-91.

Sundari, P. R. T., and Vijayalakshmi, C. (2016). A Comprehensive Review of Closed Loop Supply Chain. *Global Journal of Pure and Applied Mathematics* , Vol. 12(4), pp. 2785–2792.

Saghir, M., and Jonson, G, (2001). Packaging handling evaluation methods in the grocery retail industry. *Packaging Technology and Science*, Vol. 14(1) ,pp. 21-29.

Savaskan, RC., Bhattacharya, S., and Van Wassenhove, LN. (2004). Closed-Loop Supply Chain Models with Product Remanufacturing. *Management Science*, Vol. 50(2), pp. 239–252.

Savaskan, RC., and Van Wassenhove, LN. (2006). Reverse Channel Design: The Case of Competing Retailers. *Management Science*, Vol. 52(1), pp. 1–14.

Saha, S., Sarmah, S. P., and Moon, I. (2016). Dual channel closed-loop supply chain coordination with a reward-driven remanufacturing policy. *International Journal of Production Research*, Vol. 5(SI), pp. 153-1517.

Taleizadeh, A. A., Moshtagh, M. S., and Moon, I. (2018). Pricing, product quality, and collection optimization in a decentralized closed-loop supply chain with different channel structures: Game theoretical approach. *Journal of Cleaner Production*, Vol. 189, pp. 406-431.

Taleizadeh, A. A., Moshtagh, and M. S., Moon, I. (2017). Optimal decisions of price, quality, effort level and return policy in a three-level closed-loop supply chain based on different game theory approaches. *European Journal of Industrial Engineering*, Vol. 11(4), pp. 486–525.

Thierry, M., Salomon, M., Vannunen, J., and van Wassenhove, L. (1995). Strategic issues in product recovery management. *California Management Review*, Vol. 37(2), pp. 114-35.

Van der Laan, E., Salomon, M., Dekker, R., and Wassenhove, L.V. (1999). Inventory control in hybrid systems with remanufacturing. *Management Science*, Vol. 45(4), pp. 733-747.

Wang, N., He, Q., and Jiang, B. (2019). Hybrid closed-loop supply chains with competition in recycling and product markets. *International Journal Of Production Economics*, Vol. 217(SI), pp. 246-258.

Wan, N., and Hong, D. (2019). The impacts of subsidy policies and transfer pricing policies on the closed-loop supply chain with dual collection channels. *Journal of Cleaner Production*, Vol. 224, pp. 881–891.

Yan, W., Chai, J., Qian, Z., et al. (2018). Operational Decisions on Remanufacturing Outsourcing Involved with Corporate Environmental and Social Responsibility-A Sustainable Perspective. *Sustainability*, Vol. 10(4), 1132.

Zhao, J., Wei, J., and Li, M. (2017). Collecting channel choice and optimal decisions on pricing and collecting in a remanufacturing supply chain. *Journal of Cleaner Production*, Vol. 167, pp. 530-544.

Zou, H., Qin, J., Yang, P., and Dai, B. (2018). A Coordinated Revenue-Sharing Model for a Sustainable Closed-Loop Supply Chain. *Sustainability*, Vol. 10(9), pp. 1–15.