(Turrisi et al. 2013)		*		
(Huang & Yang 2014)	*	*	*	
(Morgan et al. 2018)		*		

Reviewed articles were focused mainly on the cost benefit, environmental sustainability, customer satisfaction and the visibility of the reverse supply chain achieved through reengineering the reverse logistics processes of an organization.

Sustainability is becoming a strategic priority for many companies and managing reverse logistics has become an attention focused field of businesses. Thus, reengineering the reverse flow of goods is a way to achieve the sustainable goals of businesses in an efficient and productive manner (Johanna, Santiago, Carlos, & Carlos, 2010). As stated by the studies managing reverse flow is essential in order to comply with the environmental and government policies and regulations. (Trrisi et al., 2013) provided evidence that adopting a closed loop structure with reverse logistics can be economically profitable. In fact, collection of end-of-life products leads to avoid the variance amplification of orders to supplier.

A closer follow-up of the operational processes and products through their life cycle, tracking and handling the returns has a positive impact on the service quality related performance of the firms (Morgan, Richey, & Autry, 2016). Reverse logistics is concerned with providing superior after service to the customers and hence, managing the reverse logistics in an efficient manner leads to higher customer satisfaction and retention. To benefit from the complementary nature of material and information flows of the supply chain and reverse logistics, a total network vision should be used to improve the coordination and collaboration among the various actors (Chouinarda et al. 2005). Therefore, reverse logistics should be redesigned in a way to improve the supply chain visibility.

According to the findings on (Jack et al., 2010), the retailers can enhance their return policies and improve their overall cost position through optimized reverse logistics operation. Reverse logistics enables the firms to reuse the products in good condition and to recycle some returns. For an example, recycling the containers of the products will save the cost of manufacturing containers and buying raw materials for the manufacturing process of those containers. This may lead to cost saving and firms can earn a profit through scrap sales as well.

5. Frameworks and models

Models and frameworks presented in the selected articles are further discussed in this section. (Refer the Table 4).

Table 4. Models/Frameworks

Study	Framework/ Model	Uses/ Advantages
(Chan, 2010)	Step by step approach to reengineer the reverse logistics process	• Better outcomes from collaborative decision making • Ability to adopt sustainable methods • Opportunity to explore new technologies
(Goldsby and Closs, 2000)	ABC to re-engineer the reverse logistics process	• Cost reduction • Beneficial to both distributor and retailor • Environmentally friendly logistic system

(Mukhopadhyay & Setaputra, 2006)	Profit-maximization model	• To jointly obtain optimal policies for the seller and the fourth party logistics provider.
(Serrato et al. 2007)	Markov Decision Model	• To evaluate the decision to outsource

A step by step approach was proposed by (Chan, 2010) for reengineering the reverse logistic process. This approach consists of six steps as defining the objectives of the reengineering project, identifying the potential improvement areas, understanding the whole logistics process and view it from a process point of view, developing manageable solutions for the potential improvement, evaluating the alternatives from the whole process point of view and finalize the decision, and implementing the new design. At the end of each step, a set of questions will be given. Its idea is to help people realize the critical issues in each step and ensure that the requirements are fulfilled before they move on. According to (Chan, 2010) both suppliers and customers can use this model and can incorporate business process reengineering into their reverse logistics process to achieve greater performance and higher customer satisfaction. This collaborative approach can be used to implement more effective and sustainable designs and methods. Also, critical analysis of the process can lead to find the hidden opportunities for potential cost savings.

(Goldsby and Closs, 2000) proposed a model based on Activity based Costing (ABC). ABC is a tool used by managers to estimate the ``true costs'' of operations more carefully. This approach illustrates an actual application of ABC to reverse logistics activities performed across supply chain organizations. Here, the approach is explained using a case study of a beverage distributor and retailer that collect empty beverage containers for recycling purposes. The case study demonstrates the ABC application in detail and discusses the reengineering of supply chain-wide processes resulting from the analysis. (Goldsby & Closs, 2000)

(Mukhopadhyay & Setaputra, 2006) proposed a model for the 4PL as an integrator of reverse logistics. The researchers have model the problem as a game and develop closed form solutions for the optimum strategies both for the seller and outsourcing the reserve logistics and for the 4PL. The optimum results obtained from the model are stated in the paper in terms of the market parameters. This study also derived a number of insights into how a manager can influence these parameters using marketing and operational strategy variables to obtain the desired optimum values for the decision variables and get the benefit of a ripple effect to increase their profits.

(Serrato et al. 2007) presents a Markov decision model to explore the hypothesis that outsourcing reverse logistics functions is more suitable when returns are more variable. It considered several elements that are critical in defining the characteristics of an reverse logistics network, such as the uncertainty in the return volume, the length of the product life cycle, the sales behavior, the particular reverse logistics costs incurred, and the length of time defined for the existence of that reverse logistics system.

6. Conclusion

Recently growing research interest towards the importance of reverse logistics have made an enormous contribution on this subject. Based on the review and the analysis of the articles, some broad suggestions for future research can be derived. Despite of the significant development achieved on this research area over the past decade, there remain many important issues for future investigation.

Reverse logistics could be a value adding operation if it is properly managed. It has a significant effect on the supply chain performance. According to the reviewed studies, reverse logistics operation can be reengineered by outsourcing, building collaborative relationships with the supply chain partners and through information technology integration. Outsourcing the reverse logistics function to firms those who have the expertise knowledge to handle these operations will result a properly managed reverse logistics operation. Effective information sharing and resource sharing plays a prominent role in reverse logistics and collaborative relationships and partnerships with the supply chain partners as well as the other industry actors will pave the way for a well-organized operation. Information technology enabled reverse logistics will be very efficient, easy to manage and will provide real time information to the organizations. Highly optimized efficient and effective reverse logistics will improve the supply chain visibility of the firm. At the same time, having an organized process to manage the market returns will improve the customer satisfaction and the

loyalty. This will also help for the customer retention. An optimized reverse logistics operation ensures the proper disposal of waste matter and this will help the firm to build an image as an environmental friendly sustainable organization. This will aid in branding and will help to gain a competitive advantage over other rivalries. Firms can also resale and recycle the returned products and can earn a profit through scrap sales. Adding the products with damaged packaging and the returned unsold products will reduce the cost of producing new products and this will leads to efficient resource handling. Thus, supply chain performance of an organization can be significantly improved by optimizing the reverse logistics through reengineering.

The conceptual framework shown in the Figure 2 illustrates the findings of the study.

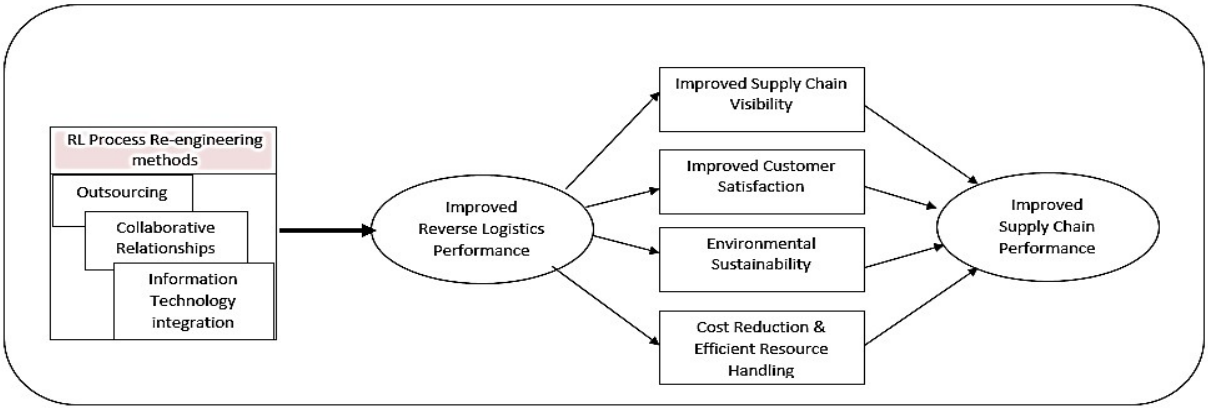

Figure 2. Conceptual Framework developed based on findings

Most of the reviewed studies were concentrated on transportation function. Very few of the researchers have focused their attention on other logistics operations like warehousing, in reverse logistics. Only few studies were conducted to identify the relationship between business process re-engineering and reverse logistics. Therefore, it is essential to conduct more studies on this area due to the fact that the reverse logistic is a key area which can achieve higher supply chain performance through re-engineering. Most of the companies are transforming to visionary organizations in order to face the high competitiveness in the market and to sustain in the industry, and such organizations which are having a clear vision of the future should conjoin optimized reverse logistics operation to their business functions. So, they are targeting on innovative ways to reduce cost and improve services through reverse logistics, and hence, it would be necessary to conduct research on finding new ways to optimize reverse logistics through re-engineering the existing processes. Researchers should focus their attention to identify new trends in the reverse logistics and innovative ways to improve the supply chain performance through re-engineering reverse logistics.

References

Bernon, M., & Cullen, J. (2007). An integrated approach to managing reverse logistics. International Journal of Logistics Research and Applications, 10(1), 41–56. https://doi.org/10.1080/13675560600717763

Bienstock, C. C. (2011). Reengineering a reverse supply chain for product returns services. *Int. J. Business Performance and Supply Chain Modelling*, *3*(4), 335–352. https://doi.org/10.1504/IJBPSCM.2011.043822

Cannella, S., Bruccoleri, M., & Framinan, J. M. (2016). Closed-loop supply chains: What reverse logistics factors influence performance? *International Journal of Production Economics*, *175*, 35–49. https://doi.org/10.1016/j.ijpe.2016.01.012

Carter, C.R. and Ellram, L.M. (1998). Reverse logistics: a review of the literature and framework for future investigation. *Journal of Business Logistics*, 19, 85–102.

Chan, H. K. (2010). A process re-engineering framework for reverse logistics based on a case study. *International Journal of Engineering Business Management*, *2*(2), 61–66. https://doi.org/10.5772/9723

Chouinarda, M., D'Amoursa, S., & Aı¨t-Kadia, D. (2005). Integration of reverse logistics activities within a supply chain information system. *Computers in Industry, 56*, 105– 124.

Goldsby, T. J., & Closs, D. J. (2000). Using activity-based costing to reengineer the reverse logistics channel. *International Journal of Physical Distribution and Logistics Management*, *30*(6), 500–514. https://doi.org/10.1108/09600030010372621

Huang, Y. C., & Yang, M. L. (2014). Reverse logistics innovation, institutional pressures and performance. *Management Research Review*, *37*(7), 615–641. https://doi.org/10.1108/MRR-03-2013-0069

Jack, E. P., Powers, T. L., & Skinner, L. (2010). Reverse logistics capabilities: Antecedents and cost savings. *International Journal of Physical Distribution and Logistics Management*, *40*(3), 228–246. https://doi.org/10.1108/09600031011035100

Johanna, C. A., Santiago, A. M., Carlos, F. R., & Carlos, P. R. (2010). Reverse Logistics Process Automation with BPMS. *IEEE ANDESCON.* Bogota, Colombia: IEEE.

Morgan, T. R., Richey, R. G., & Autry, C. W. (2016). Developing a reverse logistics competency: The influence of collaboration and information technology. *International Journal of Physical Distribution & Logistics Management, 46*(3), 293315.

Morgan, T. R., Tokman, M., Richey, R. G., & Defee, C. (2018). Resource commitment and sustainability: a reverse logistics performance process model. *International Journal of Physical Distribution & Logistics Management*, *48*(2), 164–182. https://doi.org/10.1108/IJPDLM-02-2017-0068

Mukhopadhyay, S. K., & Setaputra, R. (2006). The role of 4PL as the reverse logistics integrator:Optimal pricing and return policies. *nternational Journal of Physical Distribution & Logistics Management, 36*(9), 716-729.

Olorunniwo, F. O., & Li, X. (2010). Information sharing and collaboration practices in reverse logistics. *Supply Chain Management: An International Journal, 15*(6), 454462.

Serrato, M. A., Ryan, S. M., & Gaytán, J. (2007). A Markov decision model to evaluate outsourcing in reverse logistics. *nternational Journal of Production Research, 45*, 4289-4315.

Škapa, R., & Klapalová, A. (2012). Reverse logistics in Czech companies: Increasing interest in performance measurement. *Management Research Review*, *35*(8), 676–692. https://doi.org/10.1108/01409171211247686

Turrisi, M., Bruccoleri, M., & Cannella, S. (2013). Impact of reverse logistics on supply chain performance. *International Journal of Physical Distribution and Logistics Management*, *43*(7), 564–585. https://doi.org/10.1108/IJPDLM-04-2012-0132

Biographies

Thisuri Kaluarachchi is a final year undergraduate, reading for B.Sc.(Hons) in Management and Information Technology from department of Industrial Management of Faculty of Science, University of Kelaniya, Sri Lanka. She is specialized in the field of business system engineering.

Kalpani Sarathchandra is a final year undergraduate, reading for B.Sc.(Hons) in Management and Information Technology from department of Industrial Management of Faculty of Science, University of Kelaniya, Sri Lanka. She is specialized in the field of operations and supply chain management.

Ganguli Wijewardana is a final year undergraduate, reading for B.Sc.(Hons) in Management and Information Technology from department of Industrial Management of Faculty of Science, University of Kelaniya, Sri Lanka. She is specialized in the field of business system engineering.

Samanthi Weerabahu is a lecturer and researcher at Department of Industrial Management of Faculty of Science, University of Kelaniya, Sri Lanka in the fields of Process automation with Enterprise Resource Planning systems Management of technology, supply chain management. Her first degree was in Management and Information Technology, graduating with first class honors from University of Kelaniya and obtained her MBA in Management of Technology from University of Moratuwa. She has worked in the industry for about four years as an SAP functional consultant and she has gained expertise in material management, SAP workflow, Plant maintenance modules. Business Process Management.