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REVERSE AND GREEN LOGISTICS COST SIMULATION USING ANALYTICAL HIERARCHY PROCESS

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Abstract

The research aims to measure the effectiveness of the strategies of modern retailers which implementing reverse logistics activities, and to be believe that it could increase not only business competition, but also consumer satisfaction. The object of research is 20 modern retailers ranging from convenience stores to hypermarket stores. The methodology implemented in the form of setting parameters and assessment criteria which are arranged in the form of priority scale and analyzed using the Analytical Hierarchy Process or AHP method. The respondents are the decision makers in terms of product delivery, logistics, distribution and warehouse including making purchases both directly and indirectly. Sub parameters and sub criteria that are arranged then re-evaluated using the ExpertChoice instrument to see the resulting scale consistency. Broadly speaking, the highest priority scale was 0.441 for the criteria for agility, 0.428 for the efficiency criteria, 0.318 for the stakeholder criteria, 0.271 for the process criteria and 0.146 for the environment criteria. The result of simulation cost is less than 8 percent of the profit margin per product returned.

Keywords: Reverse Logistics; Logistics Cost; Logistics Criterion

1. Introduction

Overall reverse logistics of modern retailers combines products running in reverse through the supply chain to get maximum value. There are several reasons why retailers consider these criteria as well as financial factors which are the main factors in reverse

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logistics activities. Before starting surely business people will calculate the profit and loss of an action. Other criteria such as factors of the reverse logistics process itself, for example whether with other requests from consumers, the retailers could still be responsible for carrying out the reverse logistics activity. For further criteria such as external factors or stakeholders, which is the duty of the retailers in satisfying consumers' hearts of the quality and responsibility of the retailers itself. The next criterion is the factor of innovation and retailer's growth which includes labour and technology competencies that are already classified as sophisticated in conducting reverse logistics activities. In addition, there are also environmental criteria, which are more focused on environmental conditions and regulations that have been set, such as the use of materials, energy, and the capacity of goods that cannot be recycled again.

The last criterion is the social situation where the retailer's image is placed when conducting reverse logistics activities, in which the retailer's image looks good among the public and consumers because it has been responsible for replacing damaged returned goods by recycling to maintain environmental stability. From these criteria, the retailers will certainly assess which criteria must be prioritized first or can be said to be the most important criteria in conducting reverse logistics activities. To help retailers in terms of assessing these criteria with the aim of improving good performance, it can be applied by the Analytical Hierarchy Process method or commonly referred to as the AHP. Analytical Hierarchy Process (AHP) method is a method that can be used in terms of decision making or assessment and provides recommendations on problems faced by companies with various choices based on criteria or sub criteria based on the level of importance and main priority or ratio in the reverse logistics activity. Discussing the reverse logistics system is certainly not free from a production retailer. Many modern retailers already meet the criteria as a retailer that has implemented a reverse logistics recycling system. Based on the description in the background above, there are several phenomena that can be raised into a number of problems for the retailers, namely: (1). Are the criteria and sub-criteria as indicators of assessment in reverse logistics activities, (2) What is the average total cost or cost what modern retailers need in doing reverse logistics.

2. Literature Review

The basic concept of inventory is one of the factors that help determine the success rate of a value chain process in the pre-production, production and post-production processes (Perreri, 2015). In order to support an operational process to meet the needs and desires of consumers, including iron in the process of making iron and steel, motorized vehicle engines in the process of producing cars or motorbikes, even bread / buns, burgers and spices used by fast food restaurants, hotel soaps and shampoos, printer ink and envelopes in an office (Evans, 2007). Some categories and types of inventories are divided into Work in Process Inventory, which is inventory consisting of finished products from various stages of production that are waiting for further processing (Prakash, 2015).

Finished Goods Inventory, namely finished products that are ready to be distributed or sold to consumers, Pipeline Inventory, namely inventory that has been ordered but has not been received because the product is in transit (Kader, 2011). Anticipation Inventory, which is inventory that is intentionally made and produced in order to anticipate future needs (Kocoglu, 2011). Cycle Inventory / Order Inventory / Lot Size Inventory, which is inventory that occurs due to an order and or large purchases of more than the amount needed to be immediately used or consumed or sold to consumers (Decker, 2013). A Safety Stock Inventory, which is additional inventory that is intentionally stored in amounts greater than the average amount needed to meet consumer needs (Besterfield, 2014). In relation to the supply of paid plastic bags that have been mass produced by national retailers, the type of inventory can be categorized into the Inventory / Order Inventory / Lot Size Inventory Cycle (David, 2013).

Ordering and manufacturing of plastic shopping bags is always done in massive quantities, mass and very the amount of quantity considering the greater the quantity of the order (Logan, 2000). The more economical or efficient the cost per unit produced, especially also the national retailers have the idea that the culture of using plastic shopping bags is still very thick among the people of Indonesia (Farahani, 2011). Inventories will always coexist with inventory costs, although beforehand, an inventory manager will be faced with two main questions in inventory (Lee, 2018). The right time to place an order, or when is the right time to start the production process if the raw material to be used is also produced by the same place that will carry out the production process (Saaty, 2012). The second question is, what number of orders or productions must be carried out in each phase of ordering the product or the production phase carried out by the retailers (Heizer, 2016).

Practically it can be said that there is an exchange between the answers to these questions and the inventory costs that arise as a result or consequence of each answer (Huscroft, 2013). Basically, inventory costs are categorized into four main categories, namely, Order or Set Up Costs, Inventory-Holding Costs, Shortage Costs, and Unit Cost of The Stock Keeping Unit or SKU (Joakim, 2014). Ordering Costs or Set Up Costs occur as a result of the product ordering process to the vendor (Richards, 2014). In order to configure equipment or machinery in order to produce a product, including search and selection of vendors, vendor selection, product ordering process, document in and out process order, document inspection process, loading and unloading process up to product storage process Inventory (Matar, 2014). Holding or Inventory Carrying Cost is defined as inventory costs that occur as a result of the time period or period of storage of inventory (McWilliams, 2013). These costs are usually calculated in the form of percentage of inventory value per unit storage time or period, and storage time period or period, usually calculated per year(Meyer, 2017). Shortages or Stockout Costs are costs that arise or occur as a result of the unavailability of products to meet consumer needs (Yan, 2012). These costs describe repeated orders of goods, lost sales or even illustrate the existence of interventions or disruptions to the order process both for internal and external

purposes (Lee, 2018). Unit costs are defined as costs that occur because the production process produces a product (Robin, 2012).

3. Results

Based on the results of research on data that has been processed by researchers from the results of direct observation of the phenomena that occur in modern retailers, it can be concluded that the data obtained from interviews and questionnaires in the assessment of criteria and sub-criteria in reverse logistics activities against Quality Analysis section of the retailers. In addition, there are also additional data in the form of retailers' documents obtained by researchers with permission to the party responsible.

The conclusion can be explained as follows: (1) In accordance with the data that has been processed by researchers, using the AHP method with the help of Expert Choice produces criteria that are indicators of assessment in reverse logistics activities. The main and most important priority is occupied by stakeholder criteria and for sub-criteria with the main priority and most important is the total reverse logistics cost. (2) Based on data that has been processed, about the total costs incurred to carry out and fulfil reverse logistics activities modern retailer have average IDR 311,089 / unit if the retailers remanufacture the classification of reject major goods. Meanwhile, to regrind and virgin material mix, especially for reject minor goods, the retailers spent IDR 77,097 / unit.

Based on the results of research on the discovery of several problems faced by the retailers and until now it has not been solved and there are other alternatives to overcome the problem. Researchers here can propose a number of suggestions to overcome the problems that are owned by the retailers. These suggestions are as (1) Based on the criteria and sub-criteria that are indicators of assessment in the performance of reverse logistics activities to make it better in terms of its operations, the responsibility holders must be careful in assessing and sorting criteria and sub-criteria which are the most important priorities and must assess objectively whether the activity is going well or not. (2) Based on the calculation of the total costs incurred in modern retailers. in conducting reverse logistics activities. The retailers should do a calculation in advance clearly and in detail. So, the retailers can determine to take the next step, whether the retailers must replace the reject goods by re-making the goods, recycle the rejected goods, or even use the reject goods that can still be used and mixed with other ingredients to meet customer satisfaction, maintain retailers' image and also maintain expenditure stability.

4. Discussion and Conclusions

4.1. Criteria Cumulative Pairwise Comparison

Analytical Hierarchy Process (AHP) data processing methods using tools in calculating data Expert Choice. Data obtained from questionnaires given to twenty respondents, contains

an assessment of the most important criteria and sub-criteria and prioritized on performance in activities reverse logistics. The following are Pairwise Comparison data or pairwise comparisons of the total respondents who have been processed using Expert Choice assistance based on criteria for performance measurement of reverse logic.

Table 1 Criteria Cumulative Pairwise Comparison

Criteria	Financial	Process	Stakeholder	Innovation and Growth	Environmental	Social
Financial	1	2,8845	3,3019	3,0	1,2599	2,2894
Process	0,3467	1	2,0	3,6342	3,0	3,3019
Stakeholder	0,3028	0,5	1	2,2894	2,2894	3,6342
Innovation and Growth	0,3333	0,2752	0,4368	1	3,0	1,5874
Environmental	0,7937	0,333	0,4368	0,3333	1	2,6207
Social	0,4368	0,3028	0,2752	0,6299	0,3816	1

Source: Annas et. al, 2019

This table explains the values generated by the use and processing of the Expert Choice. However, this data is only partial, and the researcher must calculate manually to find out the results of the comparison of the total respondents. The following is a consistency test of research using the Expert Choice. This consistency test is used to determine the need for re-collection of data if the data is somewhat invalid and a new questionnaire must be distributed. If CR <0.1 then consistency can be accepted or is valid and does not need to be reassessed by other respondents.

4.2. Cumulative Respondents Consistency Ratio

Consistency Ratio Analysis was done to get CR rate and to ensure each criterion were consistent as shown in Table 2 below:

Table 2 Cumulative Respondents' Consistency Ratio

Pairwise Comparison	Consistency Ratio (CR<1)	Description
Financial Criteria	0,04	Consistent
Process Criteria	0,04	Consistent
Stakeholder Criteria	0,06	Consistent
Innovation and Growth Criteria	0,06	Consistent
Environmental Criteria	0,05	Consistent
Social Criteria	0,07	Consistent

Source: Annas et. al, 2019

From table 2 above it explains the value obtained by researchers through data processor. The value is in the form of a consistency ratio value of each criterion that becomes an object of assessment of the performance of reverse logistics activities in modern retailer. In the table describes the values that exist in each of these criteria. Among them are financial, process, stakeholder, innovation and growth, environmental, and social criteria. Of all the values of the consistency ratio nothing exceeds 0.1 which means that the value is classified as a consistent value and there is no need to redistribute the questionnaire to other respondents.

The following are the results that have been processed by researchers through a comparative calculation of the criteria and sub-criteria of the combined respondent to find out which criteria or sub-criteria are most important and prioritized by the retailers for an assessment of the questionnaire that has been addressed and processed using Expert Choice. On the graph, it can be seen that it has a consistency value of 0.05 which means that it can be concluded that the evaluation of the criteria is fairly consistent. In addition, it can be concluded that the top priority criteria or those who are in the highest position are stakeholders with a value of 0, 318, which of course satisfaction of customers or parties who work with the retailers must be more considered. In second place in the assessment of these criteria is the process criteria with a value of 0.271.

This becomes the second priority because the retailers aim at production results and concentrates with the demands of consumers and achieve productivity in terms of fast work and good results as well. The return of goods also makes the retailers more responsible and has its own value proportion of the capacity that should and should be generated. In the next position, namely the third position is occupied by environmental with a value of 0.146 because the retailers certainly think about the environmental conditions in which the retailers stand and does not harm people who live close to the location of the retailers. In addition, reverse logistics activities can help reduce the excessive use of raw materials which can damage the old environment for a long time because plastic is the most difficult to decompose. In fourth position is occupied by financial criteria with a value of 0.146. In this fourth position financial becomes the choice of the three respondents' calculations. Financial is also prioritized in reverse logistics performance, because basically to do a production or to recycle and mix new materials, still all of these require cost factors that support the smoothness and success in creating these products and can be sent back to consumers. From a financial perspective, the quality analysis must have previously conducted a review, whether the reverse logistics activity is somewhat detrimental or even damaging and can maintain environmental stability.

The fifth place is occupied by innovation and growth with a value of 0.076. That is because the criteria for innovation and growth are not so important in reverse logistics. The retailers only concentrate on the efficiency in the operation of the retailers' business relationships. However, these criteria are still included in the priority of reverse logistics activities. Where later if there are deficiencies felt by the retailers, then it must make a continuous improvement, and arrange infrastructure through innovation and learning to

develop. And for the last position, the sixth position is occupied by social criteria with a value of 0.062. This social criterion becomes the last evaluation criteria because actually it is more or less the same as the stakeholder criteria because in this criterion it also discusses the existence of a good relationship between the retailers and the social community, promotes ethical behaviour around, builds a good image for the retailers itself with fulfil the obligations and expectations of the community. So, in other words, if the relationship between the other criteria is good and is carried out by the retailers, specifically stakeholders and the environment for these criteria can be fulfilled.

4.3. Sub-Criteria Pairwise Comparison Analysis

The following is the result of data that has been processed using Expert Choice for all data regarding sub-criteria. It aims to find out which sub-criteria are most important and become the top priority in reverse logistics activities. The financial criteria have sub-criteria in them, namely total reverse logistics costs, total capital input, annual sales of returned products, and revenue recovered. Likewise, the process criteria have sub-criteria in them, namely reverse logistics cycle time, network capacity, transport capacity, and recovery efficiency rate.

After that, on stakeholder criteria, it has sub-criteria, namely customer satisfaction, government satisfaction, employee satisfaction, and investor satisfaction. Next is the innovation and growth criteria that have sub-criteria, such as management initiatives and employee competency, information technology capability, process technology innovation capability, and product life cycle reviews. Furthermore, environmental criteria that have sub-criteria such as overall environmental compliance, materials utilization, energy utilization, and disposing capability. and the last is social criteria which also certainly has sub-criteria, namely corporate image, relationships, safety, and security. Of these sub-criteria have a different value and weight with the aim to provide good performance and operations for the reverse logistics activities. The following is a graph that can show the results or weights of the sub-criteria.

Table 3 Global Weight Criteria dan Sub-Criteria

Criteria	Global Weight	Sub-Criteria	Global Weight	Ranking
Financial	0.127			
		Total RL Cost	0.506	1
		Revenue recovered	0.235	12
		Annual sales of returned products	0.107	19
		Total capital input	0.098	20
Process	0.271			
		RL cycle time	0.498	5
		Recovery efficiency rate	0.267	8

		Network capacity	0.141	15
		Transport capacity	0.093	22
Stakeholder	0.318			
		Customer satisfaction	0.542	3
		Government satisfaction	0.240	10
		Employee satisfaction	0.121	16
		Investor satisfaction	0.097	21
Innovation and growth	0.076			
		Management initiatives & employee competency	0.440	6
		Process technology innovation capability	0.30	7
		Information technology capability	0.142	14
		Product life cycle reviews	0.118	18
Environmental	0.146			
		Overall environmental compliance	0.518	4
		Material utilization	0.240	11
		Energy utilization	0.153	13
		Disposing capability	0.089	23
Social	0.62			
		Corporate image	0.552	2
		Relationships	0.253	9
		Safety	0.121	17
		Security	0.073	24

Source: Annas et. al, 2019

According to the data above, it can be concluded that the sub-criteria with the highest priority and the most important is the sub-criteria of Total Reverse Logistics Cost with a weight of 0.560. The results were obtained from a questionnaire that was distributed by the author to 3 respondents who were competent in the field of reverse logistics. The results of the questionnaire were then processed using Expert Choice. Because the results indicate that the Total Reverse Logistics Cost sub-criterion is a top priority, the researcher conducts a further review of this sub-criterion. The author focuses this research more on what costs and how much the retailers should spend to do a reverse logistics activity that can also help retailers to reduce expenses, maintain environmental stability and maintain the good name of the retailers. The calculation of the Total Cost of Reverse Logistics is divided into 4. However, in this study, the author only discusses and raises only 2

calculations due to various reasons that the author has listed in the Limitation of the problem. The calculation is the Total Cost per unit of Remanufacturing and Total Cost per unit of Regrind and Virgin Material Mix. This calculation will be explained and explained in more detail below.

4.4. Total Cost per Unit and Cost of Reverse Logistics

The following are the results of calculations to find the total costs incurred when carrying out a pure recycling without mixing with other ingredients. This calculation has the aim to help retailers make a cost estimate and calculate the costs of any costs after conducting reverse logistics activities and with the total costs already incurred can be drawn a conclusion whether the retailers suffered losses or even vice versa because it can utilize recycled products. To calculate the total cost of remanufacturing, a formula as below is needed.

Table 4 Global Unit Cost and Reverse Logistics Cost

Index	Description/Simulation
Kr	= Setup Cost Remanufacturing
	= 732
T	= Cycle Time
	= 2,173/unit
CLr	= Labour Cost for Remanufacturing
	= Total Wages : Total Quantity Returns/4.23
	= Rp 4.772.089 : 163890
	= 17,372 / unit
Cmat	= Material Cost for Remanufacturing
	= 932 / unit
hr	= Carrying Cost per Remanufactured Bottle per Cycle-Period
	= 56 / unit
Qr	= The Quantity of Bottle Remanufactured
	= 1893
Qp	= Replenishment Order Quantity in Each Cycle
	= 1
D	= The Demand Rate
	= Total Output x Cycle Time
	= 6,756,920 x 2.173
	= 6.580.257,75
λr	= Slope of Depleting Demand Rate for Remanufactured Bottles

	= Demand Rate x Cycle Time
	= 6.580.257,75 x 2.173
	= 12.732.798,75
TCUr	= Total Cost per Unit Remanufacturing
	= 874.112 [0.324)
	= Rp 412.536 / unit

Source: Annas et. al, 2019

With the above calculation, it can be concluded that the total costs to be incurred by the retailers to carry out remanufacturing activities amounted to Rp 412.536/unit. In other words, it is better to do reverse logistics activities in remanufacturing or by utilizing raw materials and to recycle them with the aim of reducing costs incurred by retailers rather than retailers having to make products from the beginning that require higher costs. In addition, the calculation of the total cost can help the retailers to estimate how much it will cost of doing reverse logistics activities by recycling reject material that can still be utilized. This is very helpful for the retailers by being linked to the total reverse logistics sub-criteria which are the first priority.

4.5. Total Cost per Unit Regrind and Virgin Material Mix

The following are the results of calculations to find the total costs incurred when carrying out a recycling but not pure, that is with a mixture with other ingredients or additives. This calculation has the aim to help retailers make a cost estimate and calculate the costs of any costs after conducting reverse logistics activities and with the total costs already incurred can be drawn a conclusion whether the retailers suffered losses or even vice versa because it can utilize recycled products. To calculate the total cost per unit of regrind and virgin material mix requires a formula like the one below:

Table 5 Total Cost per Unit Regrind

Index	Description/Simulation
Krm	= Setup cost for virgin material and regrind mixing
T	= Cycle Time
	= 1.935 / unit
CLm	= Labour Cost for virgin material and regrind mixing
	= Total Wages : Total Quantity Returns/3.21
	= Rp 4,772,089 : 152,700
	= 31,251 / unit
Cvm	= Cost of virgin material per cycle
	= 137 / unit
hr	= Carrying Cost per bottle from virgin material and regrind mixing per cycle-period

	= 60 / unit
RM	= The quantity of regrind and virgin material mix in a cycle
	= 812
Qr	= The Quantity of Product Remanufactured
	= 2236
Qp	= Replenishment Order Quantity in Each Cycle
	= 1
D	= The Demand Rate
	= Total Output x Cycle Time
	= 3,993,231 x 1,935
	= 7,726,901
λr	= Slope of Depleting Demand Rate for Remanufactured Bottles
	= Demand Rate x Cycle Time
	= 6,580,257 x 1.935
	= 12,732,797
TCUr	= Total Cost per Unit regrind and virgin material mix
	= 512,773 [0,172]
	= Rp 88,196 / unit

Source: Annas et. al, 2019

The following are the results of calculations to find the total costs incurred when carrying out a recycling but not pure, that is with a mixture with other ingredients or additives. This calculation has the aim to help retailers make a cost estimate and calculate the costs of any costs after conducting reverse logistics activities and with the total costs already incurred can be drawn a conclusion whether the retailers suffered losses or even vice versa because it can retain recycled products. To calculate the total cost per unit of regrind and virgin material mix requires a formula like the one below: With the above calculation, it can be concluded that the total cost that must be incurred by the retailers to conduct regrind and virgin material mix activities is IDR 88,196/unit.

In other words, it is better to do reverse logistics activities in terms of regrind and virgin material mix or by utilizing raw materials and mixing with raw materials or adding them with the aim of reducing the costs incurred by companies rather than retailers having to make products from the beginning that require higher costs. In addition, the calculation of the total cost can help the retailers to estimate how much it will cost of doing reverse logistics activities by recycling reject material that can still be utilized. This is very helpful for the retailers by being linked to the total reverse logistics cost sub-criteria which are the first priority.

References

Abdul-Kader, M. S. (2012). Performance measurement of reverse logistics entreprise: a comprehensive and integrated approach, *Measuring Bussines Excellence*, 16, no. 2: 23-34.

Besterfield, D. (2014). *Quality improvement*. Essex, England: Pearson Education Limited.

Cooper, D.R., & Schindler, P.S. (2014). *Business Research Methods. Twelfth edition*. Irwin. USA: McGraww-Hill.

David, I. (2013). Process for making paper bags. Accessed November 2016. http://www.ehow.com/how-does_4683110_process-making-paper-bags.html.

Decker R, Graff A. (2013). Paper vs Plastic Bag. Accessed October 2016. http://www.angelfire.com/wi/PapervsPlastic/.

Evans, J.R., & Collier, D.A. (2007). *Operations Management:an integrated goods and services approach*. Mason, USA: Thomson Higher Education.

Farahani, R., Rezapour, S., & Kardar, L. (2011). *Logistics Operations and Management*. 247-266.

Global Retail Development Index AT Kearney (2016). Accessed October 2016. https://www.atkearney.com/documents/10192/8226719/Global+Retail+Expansion+at+a+Crossroads%E2%80%932016+GRDI.pdf/dc845ffc-fe28-4623-bdd4-b36f3a443787.

Heizer, J., Render, B., & Munson, C. (2016). *Operations Management Sustainability and Supply Chain Management*. Pearson.

Huscroft, J. R., Hazen, B. T., Hall, D. J., Skipper, J. B., & Hanna, J. B. (2013). Reverse Logistics: Past Research, Current Management Issues, and Future Directions, *The Internation Journal of Logistics Management*, 304-327.

Kembro. J. (2014). Information Sharing in Supply chains, myth or reality? A Critical Analysis of Empirical Literature, *International Journal of Physical Distribution & Logistics Managemen*t, Vol.44, No.3: 179-200.

Kocoglu, I., Salih, Z.I., Ince, H., & Keskin, H. (2011). The effects of supply chain integration on information sharing:enhancing the supply chain performance, *Proceedia Social and Behavioral Sciences*, vol 24: 1630-1649.

Lee, P. T.-W. (2018). *Multi-Criteria Decision Making in Maritime Studies and Logistics*. Switzerland: Springer.

Li, Y., Muthu, S.S., Hu, J.Y., Mok, P.Y., Ding, X., Wang, X., Weibang, C. (2010). Eco impact of shopping bags: consumer attitude and government policies, *Journal of Sustain Development* 3:71-83.

Logan, M.S. 2000, "Using agency theory to design successful outsourcing relationships", International Journal of Logistics Management, Vol. 11 No. 2, pp. 21-32

Matar, N., Jaber, M. Y., & Searcy, C. (2014). A reverse logistics inventory model for plastic bottles, *The International Journal of Logistics Management*, 315-333.

McWilliams, J.T. (2013). 10 steps to plastic bags. Accessed August 2016. http://www.5starwriting.com/wp/content/uploads/2011/06/10_steps_to_plastic_bags_May06.pdf.

Meyer, A., Niemann, W., Mackenzie, J., & Lombaard, J. (2017). Drivers and barriers of reverse logistics practices: A study of large grocery retailers in South Africa, *Journal of Transport and Supply Chain Management*.

Muthu, S.S., Li, Y., Ze, L. (2011). Role of human factors in environmental sustainability: a case study of shopping bags consumption, Energy Education Science Technology Part B:Social Education Study, Vol. 5, no. 2:793-808.

Norman, W. (2013). Procedure for plastic bag manufacturing. Accessed November 2016. http://www.ehow.com/facts_6819404_procedure-plastic-bag-manufacturing.html.

Pererri, U., Tatham, P., Wu, Y., & Sgarbossa, F. (2015). Reverse logistics in humanitarian operations: challenges and opportunities. *Journal of Humanitarian Logistics and Supply Chain Management*, Vol. 5, no. 2: 256-274.

Prakash, C., Barua, M. K., & Pandya, K. V. (2015). Barriers Analysis for Reverse Logistics Implementation in Indian Electronics Industry using Fuzzy Analytic Hierarchy Process, *Annual International Conference of the Society of Operations Management*, 91-102.

Richards, G. (2014). *Warehouse Management: A Complete Guide To Improving Efficiency and Minimizing Costs In The Modern Warehouse*. Great Britain and The United States: Kogan Page Limited.

Robbin, S., & Coulter, M. (2012). *Management 11th Edition*. Pearson.

Saaty, L. T., & Vargas, L. G. (2012). *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process*. New York: Springer.