Impact of Reverse Logistics Applications on Customer Satisfaction

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Abstract

Extension of used-product recovery strategies is increasing in both the industrial and service sectors due to its environmental, economic and social benefits. The steady supply of used product is critical for any product recovery as it clearly cannot proceed without reverse supply. The movement of used products from the consumer to the producer in the distribution channel is defined as reverse logistics. The literature review showed several drivers for reverse logistics that enforce organization for application such as legislation and obligation, increasing waste, customer awareness of green products. Many authors clarified the benefits of reverse logistics application such as customer satisfaction, saving costs and provision of cheaper products in the market. Most of the previous studies concern with demonstrating the reverse logistics application in different sector. However, there are few studies that examined the impact of reverse logistics on customer satisfaction. Therefore, this research investigates the implementation of reverse logistics for remanufacturing strategy in one of the heavy manufacturing sector, Caterpillar, and its agent in Egypt, Mantrac and its impact on customer satisfaction levels. The researchers used a case study approach to investigate the application of reverse logistics in real life context in Mantrac using semi-structured interviews that conducted with the reverse logistics executives in the case. Then, questionnaire is used to test the research hypothesis which is the application of reverse logistics has significant impact on customer satisfaction.

Keywords
Reverse Logistics, Green Supply Chain, End of Life, Remanufactured Product, Deposit system.

1. Introduction
Product recovery refers to the set of activities designed to reclaim value from a product at the end of its useful life (Ferrer and Whybark, 2000). Over this decade, many companies are engaged in product recovery strategies due to increasing environmental deterioration, government regulations, social responsibilities, resource reduction, and economic factors (Sasikumar et al., 2010). Ferrer and Whybark (2000) and Georgiadis and Vlachos (2004) stated that

the four recovery strategies "4 Rs" are reuse, repair, remanufacturing, and recycling. For many years, the definition of remanufacturing has been the source of many discussions. Ijomah (2002) concluded the concepts of remanufacturing discussed by many authors (Haynesworth and Lyons, 1987; Amezquita, 1996 and Jacobsson, 2000) by proposing a robust definition to clarify the concept of remanufacturing: *"Remanufacturing is the process of returning a used product to at least the OEM original performance specification from the customers' perspective and giving the resultant product a warranty that is at least equal to that of a newly manufactured equivalent."* The benefits of remanufacturing have been put into figures by Giutini and Gaudette (2003) who found that remanufactured products cost 40% to 65% less to produce than new products, are typically 30% to 40% cheaper for the customer to buy, and save globally the energy equivalent of 16 million barrels of oil annually. That means that the benefits of remanufactured can be seen in almost every aspect of the industry, giving lower cost as well as more profit to companies, saves tons of energy that can be used by the government elsewhere, and giving the customers cheaper products. To show how much the remanufacture can affect any industry, a case study was done by Sundin (2007) and Lee (2004) shows that 11 of 12 environmental research studies found remanufacturing as a preferable option, at least in comparison to new manufacturing. De Brito and Dekker (2002) cited by Krikke (1998)**,** declared that the remanufactured product can include components that can be either purchased new or retrieved from return products, depending on availability and costs. According to the previous studies (Lund, 1983; Giuntini ,2001; Giuntini and Gaudette, 2003; Resource Rcovery fourm, 2004) heavy machine sector is the original sector for reverse logistics process for remanufacturing and there is an extension of the reverse logistics in this sector.

Also, Guide (2000) and Ijomah et al. (1999) declared that the complexity of the remanufacturing process lies in the uncertainty in timing, quality and quantity of the returns. These factors make the acquisition of the core a difficult task and the reverse network a complex structure. Therefore, an efficient acquisition and reverse distribution system is essential for the tracing of returns as well as collecting and transporting them to the remanufacturing plant. Moreover, it should be efficient enough to generate and handle a sufficient return flow. The handling and packaging of returns are quite different from the methods used in the forward logistics chain of new products. This is perhaps because of the high variability in the physical state and volume of returns. Additionally, product variety is higher in the case of reverse logistics. Therefore, Srivastava (2008) confirmed that designing an effective and efficient reverse logistics system is a prerequisite for remanufacturing and a key driver for providing the economic benefits necessary to initiate and sustain customer relationship and customer loyalty.

According to Reverse Logistics Association (2009) reverse logistics is defined as "all activities associated with a product/service after the point of sale, the ultimate goal to optimize or make more efficient aftermarket activity, thus saving money and environmental resources". In the other hand Roger and Tibben-Lembke, (1998) modelled the definition in "The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal".

Brito (2004) concluded that organizations are being involved in reverse logistics for two main reasons; first, that companies looking at the reverse logistics practices as a source of profit. And the other reason due to environmental laws and regulations that they have to obey. Partida (2011) shared Brito the same opinion with an additional thought at which customer's stake holders and competitors will have a huge influence on the company that will impose by force the adoption of reverse logistics concept.

Many authors (Thierry et al., (1995); Prahinski and Kocabasoglu, (2006); Srivastava, 2008) clarified that reverse supply chain processes can be structured sequentially by five steps, as shown in Figure 1: product acquisition, transportation and warehousing, inspection, recovery process, and distribution and sales.

It's the most important and vital process in reverse logistics management at which it depends in acquiring the core/used products or the most important part in the returned product the core is the part of the returned product that will be used in the remanufacturing process, Electronic remanufacturing company (ERC) stated that "who owns the core owns the market" (Caterpillar Inc., 2014) mentioned even "cores are the backbones of the Caterpillar remanufacturing".

Core Acquisition Management is the activity or the process of active management of the quality, quantity and even the timing of the collected cores and the importance of fixing. The authors declared the proper criteria among collecting the core lies in its effect on choosing facility design, production planning and control policies, and inventory policies (Guide and Van Wassenhove 2001). stated that a large portion of reverse logistics is concerned with core

acquisition management because it is a key input to assessing the potential economic attractiveness of reuse or remanufacture activities. Therefore, they rejected the idea that the firm should passively accept product returns and showed that the system to control returned products should exit. Also, the authors clarified the vital and the primary importance of core acquisition management is to reduce the uncertainty return process, strike a balance between demand and supply, a key input for assessing the potential economic attractiveness of recovery process, grantee the continuity of the RL system and increase the customer satisfaction of reverse logistics system.

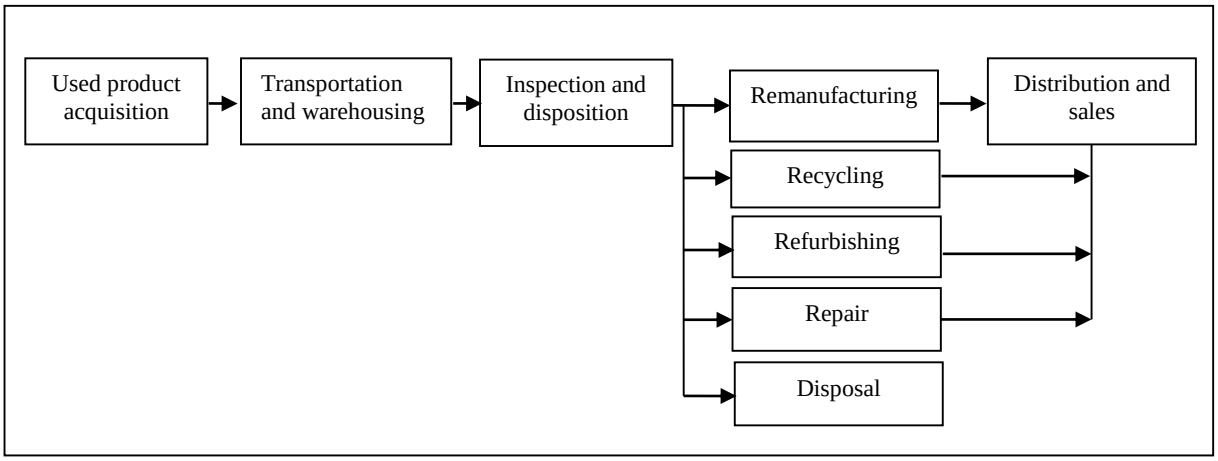

Figure 1: The general activities and recovery alternatives in the reverse supply chain (according to Thierry et al., (1995); Prahinski and Kocabasoglu, 2006; Srivastava, 2008)

Although a lot of achievements have been made in recent years in reverse logistics, it is still a researching field. Most of the previous studies focused on understanding the reverse logistics process, determining the location of collecting centers and reprocessing centers. However the importance of core Acquisition process, there are a few studies by (Smith, (2005); Fernández and Junquera (2005); Pollock (2007); Cannella, (2013)) which investigate the core acquisition strategies as the criterial process in reverse logistics system and its impact on customer satisfaction.

Therefore, the main objectives of this research are to investigate reverse logistics practices in heavy manufacturing sector in Egypt, measure the level of customer's satisfaction against return policies and measure the level of customer satisfaction against remanufactured products performance. This paper starts with reviewing the literature on reverse logistics application in particular the types of core Acquisition strategies and its impact on the customer satisfaction level. Then, the research methodology and finally the results of the research and its consistency with the research hypothesis.

2. Literature Review

The researcher reviewed the published literature that focused on the application of reverse logistics and its impact on the customer satisfaction including books, conference proceedings, and literature obtained from electronic sources. Search engines were used such as Google Scholar, Science Direct, Emerald Insight, IEEE, Springer Link and Inderscience databases for literature. Keywords such as '*remanufacturing'*, '*product returns'*, '*product recovery'*, '*reverse logistics'*, '*end-of-life products*', '*closed-loop supply chains'*, '*reverse supply chain'* were used to find related literature. The publications were found in the areas of logistics management, production and operations management, engineering management and business logistics. The references cited in each relevant literature were examined to find additional sources of information.

Fleischmann et al. (1997) clarified that the literature of the reverse logistics activities is divided into three research areas: distribution planning, inventory control, and production planning. However, Dowlatshahi (2000) stated that the research done in RL is mostly in practitioner-related journals rather than academic journals. The author stated that "the majority of the articles show lack of depth, do not describe the basic structure of Reverse Logistics, and do not

define the basic concepts and terms". Consequently, the attention to the literature and listed the strategic and operational factors in the reverse logistics systems are provided.

Smith, (2005), demonstrated the "Reverse logistics programs: gauging their effects on CRM and online behavior" and the main purpose beyond this research was to provide practitioners of knowledge management with a sense of the importance of reverse logistics as an important part of today's company policies, especially throughout the product life cycle, with the accompanying technology that supports it and the effects on customer relation management (CRM) and satisfaction. And as a result in order to remain competitive, firms must develop reverse logistics systems that rival traditional systems in terms of efficiency, cost-effectiveness, competitiveness, and customer satisfaction.

Fernández, Junquera (2005) represented that there is a great "Role of Reverse Logistics in Repair Customer Support" and how the reverse logistics right implementations could effectively affect customer satisfaction. Pollock (2007), reviewed that the Usage of Reverse Logistics will Enhance Customer Service and Competitive Performance of any company.

Jack et al (2010) showed that "Reverse logistics capabilities will lead to antecedents and cost savings and even it helps in involving customers to give feedback about the way they feel about companies implementing reverse practices. Sundin and Dunbäck (2013) identified different Types of Core Acquisition strategies that used to collect the used products which includes direct-order, re-man contract, deposit-based, credit-based, and buy-back which used by the companies in different sectors. In the same year, Turrisi et al (2013) discussed the "Impact of reverse logistics on supply chain performance" and how it will improve all the supply chain performance and in the end this development will lead to increase customer satisfaction and fulfilling their demands. And Badenhorst summarized the benefits of an effective reverse logistics system in three main categories: Cost reductions, Waste and environmental cost reductions and Customer satisfaction which considered as a tool for customer satisfaction and enhance customer perception on product quality.

2.1 Research Hypothesis

According to those previous studies which done by (Smith (2005), Fernandez and Junquera (2005) and Pollock (2007), Turrisi et al (2013)) the research hypothesis is established as follows:
H: The implementation of reverse logistics practices has positive impact on the customer satisfaction level.

3. Research Methodology

This research explores and describes the application of reverse logistics in the real-life context in heavy machine sector and particularly the core acquisition process. Also, it extends to analyze and measure the relationship between the application of reverse logistics and customer satisfaction level. Therefore, this research is a combination between descriptive, analytical and exploratory research according to the research objectives. The case study approach was conducted to investigate the practical application and situation that involves the human being. This investigation helped the researcher to:

- Understand reverse logistics activities in heavy machine sector in real-life context, used by the practitioners.
- Understand the core acquisition process for the used products during the reverse logistics.
- Measure the level of customer satisfaction for the application of reverses logistics and in particularly the acquisition process and Reman products.

The researcher found that the mixed method is convenient to conduct the research due to the nature of research objectives and hypotheses. The mixed paradigm (qualitative and quantitative data) gave opportunity to the researcher to:

- Describe and analyze the reverse logistics activities in real life context through using interviews and observations.
- Measure the level of customer satisfaction about the reverse logistics application using questionnaire.

In this research, a survey is conducted through the internet and literature review to identify the companies that perform reverse logistics activities in heavy machines. The researchers selected Mantrac-CAT as cases study because it complies with the following criteria for case study selection that identified by the researchers:

- High annual remanufacturing volumes.
- Extended experience in performing reverse logistics for remanufacturing.
- Formal relation to OEMs, and

- Accessibility to the researchers.

3.1 Data collection Methods

Semi-structured Interviews

The researchers conducted semi-structured interviews, which include 14 open questions with general themes about the application of reverse logistics and core acquisition process. These interviews were conducted with key personnel (core management manager) in the case study.

Questionnaire

The researchers used questionnaire to measure the level of customer satisfaction regarding the application of reverse logistics. The questionnaire was designed based questionnaire that was designed by Smith (2012) to measure customer satisfaction. The researchers are used Statistical Package for the Social Science software (SPSS) to analyse the data and find the correlation between customer satisfaction and the application of reverse logistics.

Direct observation

During the visits to the case study to conduct the interviews, the researcher observed the application of reverse logistics processes in real life conduct.

Documentation

The case study provided the researcher with the different types of documents that used in the application of RL such as (core deposit form and core inspection form). These types of documentation were mainly used for data triangulation to validate the collected data from interviews and observations.

4. Results and discussion

This section presents the findings of the case study and the analysis of these findings. It starts with the semi-structured interviews findings and then the findings of questionnaire. The findings analysis provided the researchers with the knowledge of reverse logistics implementations in particularly the core acquisition process and the customer satisfaction level regarding the core acquisition process.

4.1 Results of Semi-structured Interviews

The interviews were held with reverse logistics and core management supervisors that responsible to manage the whole RL system for Re-man products inspection, consolidation as well as account management of the whole process with Caterpillar.

The case study sells only two types of products; new products/ part and Re-man product/part to two types of the customers:

- Individuals
- Organizations: The company offers its equipment to a lot of huge organizations in private and governmental institutions and ministries.

The supervisors clarified that the Reverse logistics for Re-man program has three main types of service which are:

1. Repair: - which is fixing what seems wrong and go on
2. Rebuild: - restore near original condition
3. Re-man: - performs like new and it will include CAT warranty and a highly advanced technology product.

- The cycle of RL starts with the Re-man product acquisition, when the customer wants to buy a Re-man product. The sales personal asked the customer to return worn-out core. The customers use 2 main ways to deliver the worn-out parts to Mantrac, either by:
  - coming directly to the counter and giving them the worn-out part and asking for another Re-man part or
  - by maintenance center, when the customer goes to repair his equipment, which part of it needs to be replaced, the maintenance center engineers offers the customer the choice to replace it with a totally new part or with a Re-man part (which gives the customer the ability to get back part of the amount of money that he paid, that is the deposit).

Figure 2 shows the cycle of reverse logistics system for the Re-man products.

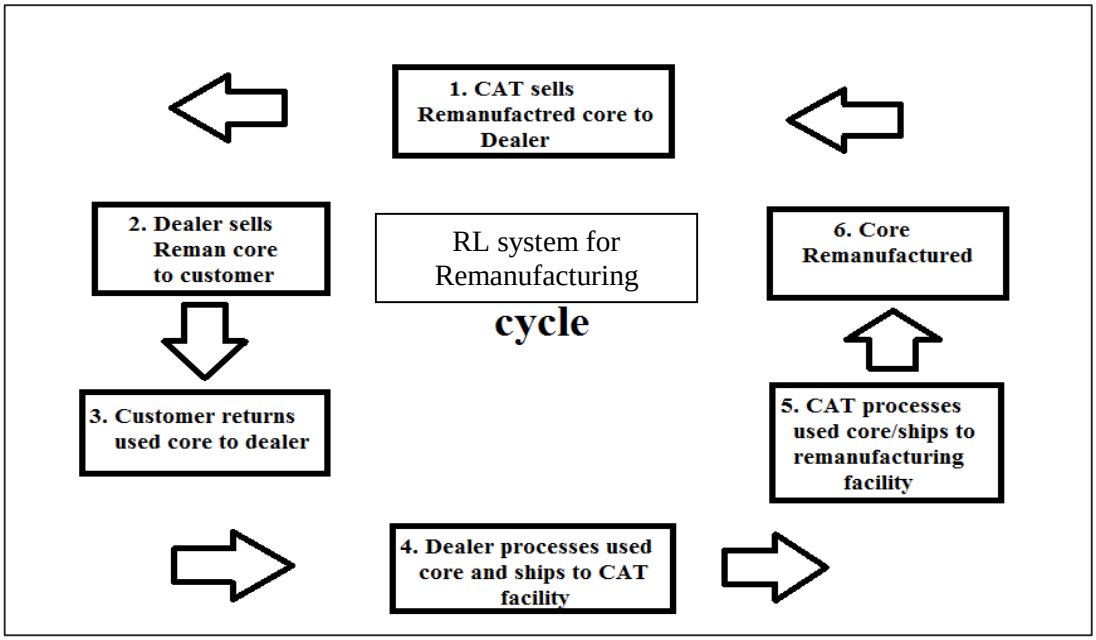

Figure 2: Reverse logistics system for remanufacturing products in the case study

1. The case study sells the Re-man cores to all its dealers around the world. (Mantrac as the main dealer in Egypt & the Middle East).
2. Then, the dealers sell the Re-man cores to the customer, which can be organizations or individuals.
3. In order for the customer to acquire a Re-man product, the customer must return used core/ worn-out core.
4. The dealer (like Mantrac in Egypt) processes the worn-out cores then ships it to CAT core facility.
5. Caterpillar processes the cores once more to ensure it's up to the criteria, and ships it to the Remanufacturing facility.
6. The worn-out core is then remanufactured and is ready to enter the remanufacturing cycle once more.

- When the customer buys the product, an entitlement is opened for them for 18 months as well from the date that the customer bought it from the dealer (Mantrac). Even if the customer bought the Re-man part 7 months later, he still gets the same 18 months, as Mantrac applies FIFO (First in First Out).
- If the customer bought a Re-man product, which takes "10R"on the product barcode, the invoice goes out with TWO dates; the purchasing date and the close of entitlement date. By this, the customer has the option to return the worn-out core and take another Re-man one, which gives the customer the deposit back, meaning that the customer will get the product for a fewer price.
- Then, the core inspectors scan the part to determine wither the company will get full deposit back (totally accepted part) or gets some of it back if the part is damaged (Partially accepted), as shown in figure 4.3.
- The supervisors explained that the company only faced a problem in the past with the acquisition process which was the mindset of the customers. The customers used to do a special mark on the product to number it. Which would make the customer loss the money of the deposit as it won't be accepted or at less it will be partially accepted. The company had to tell the customers that those marks weren't accepted.
- In order for the remanufacturing process cycle continues and for the company and customer to stay profitable, customer must follow some procedures, in order to guarantee that he will get what he wants in the best deal, weather in price or quality. So this cycle mainly starts by:
  1. The core acquisition itself at which the customer will bring the product that needs to be remanufactured to the company. At which the product will be analyzed through two different sources first the company counter at which the customer will need to change a specific part from the equipment and the other source which is the periodical maintenance workplace at this point the customer will get feedback from the engineers about the parts that need to be changed.
  2. After that, the customer has the freedom to choose to install a re-man product or a new product.

3. Then the parts that have been taken will pass through an examination process that will give the company the final report about the product core itself and how much cash should be returned to the customer as a deposit.

5. Results from Questionnaires

The researchers used questionnaire to measure the level of customer satisfaction regarding the application of reverse logistics and in particular the core Acquisition process. The questionnaire was designed based questionnaire that was designed by Smith (2012) to measure customer satisfaction. The questionnaire includes two sections. Section 1 includes 12 questions that used by the researchers to measure the customer satisfaction regarding to the acquisition process in terms of service quality dimensions. Section 2 includes 8 questions that used by the researchers to measure the customer satisfaction regarding to remanufactured products (Reman) in terms of product quality dimensions. The researchers collected 36 questionnaires only due to limited time of research and inaccessible customers.

5.1 Acquisition Process (section 1 in the questionnaire)

Table1 calculates the acquisition process and the percentage of customers satisfied by it. 15 of the customers (41.7%) were "Satisfied" with it, while 15 other customers (41.7%) just stated "Neutral", and 6 customers (16.7%) were "Unsatisfied" with the acquisition process.

Table 4.2: acquisition process and the percentage of customers' satisfaction

Acquisition Process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Satisfied	15	41.7	41.7	41.7
	Neutral	15	41.7	41.7	83.3
	Unsatisfied	6	16.7	16.7	100.0
	Total	36	100.0	100.0	

This means that the percentage of satisfied customers is higher than the percentage of the unsatisfied customers. But also mean that a huge percentage of customers are neither satisfied nor unsatisfied with it.

Service Representative: Table 2 calculates the satisfaction of customers when it comes to service representative. The simulation shows that 6 customers (16.7%) are "Very Satisfied" with the service representative, 21 customers (58.3%) are "Satisfied", 7 customers (19.4%) just choose "Neutral", and only 2 customers (5.6%) are "Unsatisfied".

Table 4.2: satisfaction of customers when it comes to service representative.

Service Representative

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	6	16.7	16.7	16.7
	Satisfied	21	58.3	58.3	75.0
	Neutral	7	19.4	19.4	94.4
	Unsatisfied	2	5.6	5.6	100.0
	Total	36	100.0	100.0	

This means that, the highest percentage of customer base (58.3%) are Satisfied with the performance of the service representative of the dealer (Mantrac) and only 5.6% of them are Unsatisfied.

Technology & Specification: Table 3 calculates the satisfaction of customers with the technology and specifications of the products offered by Mantrac. The simulation shows that 12 customers (33.3%) are "Very Satisfied" with the product's specifications and the technology used in it, 14 customers (38.9%) are "Satisfied", 7 customers (19.4%) just choose "Neutral" while 3 customers (8.3%) are "Unsatisfied" with the technology and specification of the products.

Table 3: satisfaction of customers with the technology and specifications of the products

Technology & Specification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	12	33.3	33.3	33.3
	Satisfied	14	38.9	38.9	72.2
	Neutral	7	19.4	19.4	91.7
	Unsatisfied	3	8.3	8.3	100.0
	Total	36	100.0	100.0	

From the above calculations we can see that the highest majority of customers with a percentage of 72.2% are between "Very Satisfied" and "Satisfied" with the technologies and specifications offered by Mantrac, While 8.3% of the customers are "Unsatisfied" with them.

Green Concept effect on the decision: Table 4 calculates the satisfaction of customers with the environmental effect of the products and if it fulfils the customers green concept. The simulation shows that 17 customers (47.2%) are "Very Satisfied" with how the product helps them fulfill their green concept, 17 customers (47.2%) are "Satisfied", 1 customer (2.8%) just choose "Neutral" while only 1 customer (2.8%) are "Unsatisfied" with it.

Table 4: satisfaction of customers with the environmental effect of the products

Green Concept effct decision

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	17	47.2	47.2	47.2
	Satisfied	17	47.2	47.2	94.4
	Neutral	1	2.8	2.8	97.2
	Unsatisfied	1	2.8	2.8	100.0
	Total	36	100.0	100.0	

From the above calculations, it is clear that the high majority of customers are between "Very Satisfied" and "Satisfied" of how the remanufactured product helps them achieve green concept with a percentage of 94.44%

Overall Satisfaction with the dealer performance (Mantrac): When it came to the overall satisfaction with Mantrac, 30 customers (83.3%) are "Satisfied" with the overall performance of Mantrac, while only 6 customers (16.7%) are just "Neutral".

Overall Satisfaction with Mantrac

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Satisfied	30	83.3	83.3	83.3
	Neutral	6	16.7	16.7	100.0
	Total	36	100.0	100.0	

Table 5 overall satisfaction with the dealer performance (Mantrac)

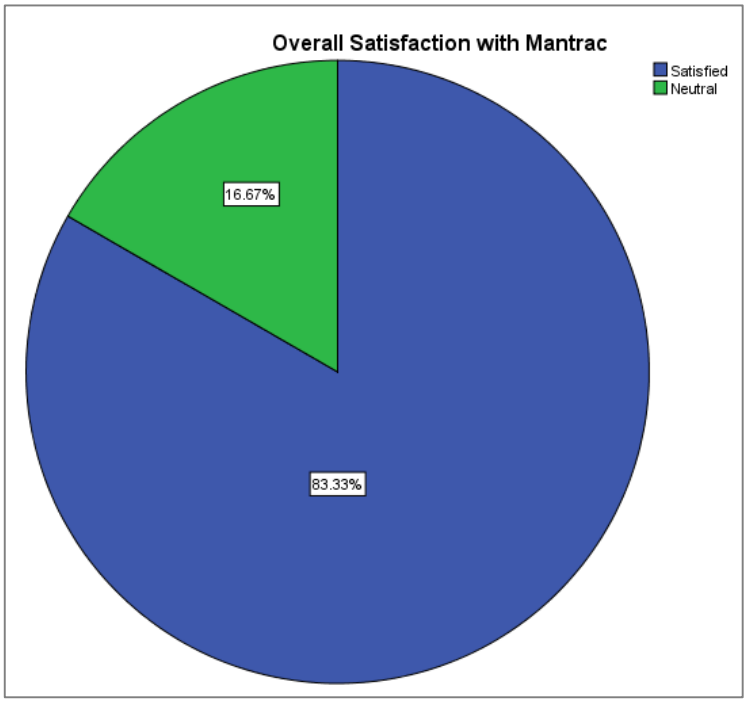

Figure 3: Overall Percentage of Satisfaction with dealer (Mantrac)

That means that the highest majority of customers think that the overall performance done by Mantrac is satisfying. After asking about the customers' satisfaction level overall with Mantrac, the researchers specified other questions to focus on the Re-man products quality and price and to what level the customers are satisfied with them.

Re-man Products Price: Table 5 calculates the satisfaction of customers with the price of Re-man products. The simulation shows that 4 customers (11.1%) are "Very Satisfied", 19 customers (52.8%) are "Satisfied", 10 customer (27.8%) just choose "Neutral" while 2 customer (5.6%) are "Unsatisfied" with it and surprisingly 1 customer (2.8%) is "Very Unsatisfied". That means that a high percentage of 63.9% of the customers are between "Very Satisfied" and "Satisfied" with the price, but also means that not a small percentage of customer of 8.4% are "Unsatisfied" and "Very Unsatisfied" with it.

Table 5: satisfaction of customers with the price of Re-man products

Reman products price

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	4	11.1	11.1	11.1
	Satisfied	19	52.8	52.8	63.9
	Neutral	10	27.8	27.8	91.7
	Unsatisfied	2	5.6	5.6	97.2
	Very Unsatisfied	1	2.8	2.8	100.0
	Total	36	100.0	100.0	

Re-man Products Value for Money: Table 6 calculates the satisfaction of customers with the value for money of Re-man products that they receive. The simulation shows that 5 customers (13.9%) are "Very Satisfied", 11

customers (30.6%) are “Satisfied”, 18 customer (50%) just choose “Neutral” while 1 customer (2.8%) is “Unsatisfied” with it as well as 1 customer (2.8%) is “Very Unsatisfied”.

Table 6: Satisfaction of customers with the value for money of Re-man products.

Reman products Value for money

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	5	13.9	13.9	13.9
	Satisfied	11	30.6	30.6	44.4
	Neutral	18	50.0	50.0	94.4
	Unsatisfied	1	2.8	2.8	97.2
	Very Unsatisfied	1	2.8	2.8	100.0
	Total	36	100.0	100.0	

That means that a high percentage of 50% of the customers are “Neutral”, neither satisfied nor unsatisfied.

Overall Satisfaction with Re-man products: Table 7 calculates the overall satisfaction of customers with Re-man products. The simulation shows that 4 customers (11.1%) are “Very Satisfied”, 18 customers (50%) are “Satisfied”, 13 customer (36.1%) just choose “Neutral” while 1 customer (2.8%) is “Very Unsatisfied” with it.

Table 7: overall satisfaction of customers with Re-man products.

Overall Satisfaction with Reman products

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	4	11.1	11.1	11.1
	Satisfied	18	50.0	50.0	61.1
	Neutral	13	36.1	36.1	97.2
	Very Unsatisfied	1	2.8	2.8	100.0
	Total	36	100.0	100.0	

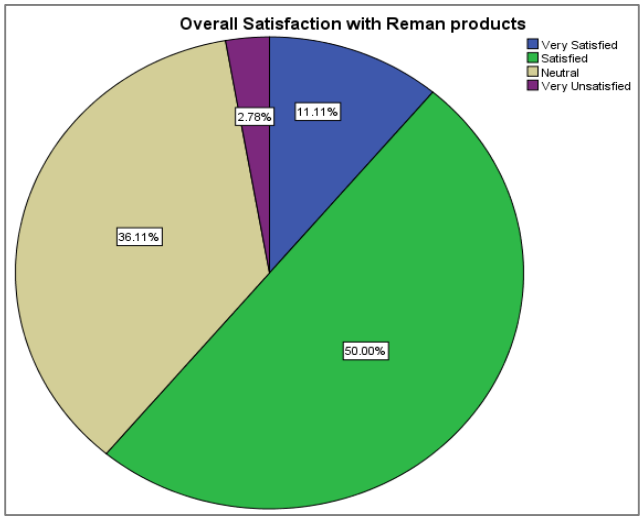

Figure 4: Overall Satisfaction of Customers’ Percentage with Re-Man Products.

From the calculations done above, it is shown from figure 4 that the highest majority of customers are between "Very Satisfied" and "Satisfied" from the overall "Re-man products" from quality and price with 66.11%.

6. Conclusion and Recommendations

To conclude the results of 36 questionnaires regarding to the effect of the acquisition process and remanufactured products on the customer overall satisfaction, table 8 shows the effect of quality of service and product dimensions that dealer (Mantrac) serves on the customer overall satisfaction. As shown in the table, the variables that have a significant impact on the overall customer satisfaction are:

- Re-man products price. (with 0.651 significance).
- Re-man products value for money. (with 0.457 significance).
- Service representative. (with 0.149 significance).

Table 8: Main Findings of SPSS.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.407	.249		1.639	.112
	Acquisition Process	-.005	.078	-.005	-.063	.950
	Service Representative	-.155	.076	-.149	-2.040	.051
	Reverse Logistics Mangaer	-.041	.104	-.026	-.393	.697
	Technology & Specification	-.057	.048	-.068	-1.187	.245
	Green Concept effct decision	.024	.068	.021	.351	.728
	Reman products price	.596	.083	.651	7.206	.000
	Reman products Value for money	.413	.077	.457	5.326	.000

a. Dependent Variable: Overall Satisfaction with Reman products

This means that the most important parameters for the customers, in the Middle East and especially in Egypt, is the product price, after that comes the value for money, which is the quality and performance of the product, which all customers focus on. Last significant factor that affects the customers' satisfaction is the service representatives and acquisition process.

The results confirm the research hypothesis which is the significant impact of reverse logistics on customer satisfaction in terms of the re-man product price and quality, and a lower impact done by the service representative and acquisition process. Based on the research results, the researchers recommend the followings:

- Companies in the heavy machine sector shall follow Caterpillar's reverse logistics strategy in order to maintain their sustainability and to delight their customers.
- New technology in the remanufacturing sector that was introduced by Caterpillar has clearly affected on the customers decision when it comes in replacing a malfunctioning part in a machine.
- Any company seeks to apply the green practices to minimize its impact on the environment shall apply the reverse logistics for product strategies.

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