Current Reverse Logistics Practices And The Value-added Effect:
A Survey in Electronic Industry in China

Yacan Wang, Junjun Yu, Yakun Wang

Abstract
The extant research on reverse logistics has primarily focused on reverse logistics channels and final disposition options, leaving important issues involving types of returns, reasons for returns and added-value effect from reverse logistics unaddressed. This exploratory study adds to the literature by investigating the current status of reverse logistics practice and its added-value effect in electronics industry. The survey was conducted by 150 electronic companies in Guangdong of China, providing detailed information on types and reasons of returns, reverse logistics channels, final disposition options and the added value from reverse logistics. Results indicate that although reverse logistics does bring added value to companies, especially to the growth and development of company, there still exist some problems in managing the returns. Some suggestions concerning how to improve the efficiency of reverse logistics are proposed.

Keywords: Reverse Logistics, Value Added, Empirical Research, Survey Study, Electronic Industry, Guangdong Province of China

1. Introduction
Reverse logistics (RL) can be defined as the process of planning, implementing, and controlling the efficient 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 creating value or proper disposal. A survey from the International Reverse Logistics Association in 2010 shows that 40% of the enterprises surveyed believe RL is comparatively unimportant, that 35% haven’t set up a sound RL system, not even to mention incorporating it into their development strategy; To more than 30% of the enterprises, reverse logistics is nothing more than a passive environmental protection strategy, which can waste a huge amount of time and money instead of adding values to the economy.

Extant literatures on reverse logistics are dominated by standardized quantitative analysis (e.g. Fleischmann et al., 1997, Songtao Zhang et al., 2012); case studies (e.g. Brito & Dekker, 2004) and studies on theoretical framework. During 1995-2005, empirical studies based on survey (Rubio et al., 2008) totaled barely 5%. The empirical studies mainly focus on RL channels and the disposition of the return products, leaving important issues involving types of returns, reasons for returns and added value effects from reverse logistics unaddressed. There are no empirical studies concerning the reverse logistics practices and its value-added effect in China, which resulted in lack of validity in theory and low applicability in findings of related research.

As the most economically developed province in China, Guangdong is the principal production and export base, with the export volume and product sales accounting for one third of the total in China. In recent years, driven by the Chinese government initiatives of Circular Economy, reverse logistics activities have been carried out and integrated in business of electronic enterprises in Guangdong province. Therefore, Guangdong has provided an ideal environment to conduct surveys.

This paper aims at empirically examining the concrete status of the reverse logistics practices in electronic manufacturers of Guangdong and the added value effect. To sum up, this paper attempts at answering the following two questions:
Question 1: What is the situation of the reverse logistic practices in electronic industry in Guangdong province, in terms of types of the return, return channels, recovery and disposition channels etc.?

Question 2: How is the added value effect of reverse logistics practices? What is the principal factor contributing the added-value?

The set-up of the paper is as follows. Section 2 reviews the literature; section 3 introduces the research methodology; section 4 analyzes the data results; section 5 summarizes the research findings and offers managerial suggestion. Then the paper ends with the limitation of the paper and puts forward the potential topics for future research.

2. Literature Review

The integrated reverse logistics practices cover the whole reverse supply chain, from the returned products confirmation to the disposition of the returned products and then to the disposition of the returned products. Brito et al. (2004) divide the returned products into 6 categories: Marketing/sales returns, warranty returns, end of lease returns, and end of life returns, packaging/pallet returns, others.

In order to recycle products more effectively, enterprises develop the following collection channels: the previous forward sales and distribution channels, separate reverse logistic channels and the integrated forward and reverse channels (Fleischmann et al., 1997). There are several disposition methods for returned products: direct sale or use; repair, refurbishment or remanufacturing; recycling the available resource or parts after disassembling or incinerating or land-filling the unavailable parts (Thierry et al., 1995).

Six reasons were founded to cause these returns: defective, customer dissatisfied with product performance, product damaged during shipment, errors or delays in delivery, cancellation of sale orders, stock adjustment (Krikke, 2005).

<table>
<thead>
<tr>
<th>Name/Time</th>
<th>Industry/country</th>
<th>Data processing method</th>
<th>Reverse Logistics Practices</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johnson (1998)</td>
<td>Manufacturing industry in two states of U.S.</td>
<td>case analysis</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Felix et al. (2008)</td>
<td>Hongkong,China mobile phone</td>
<td>descriptive statistics</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>√</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Hernández (2010)</td>
<td>Brazil automobile</td>
<td>analytic hierarchy process</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Ramanathan (2011)</td>
<td>electronic commerce</td>
<td>correlation analysis, regression</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Cherng et al. (2012)</td>
<td>Taiwan,China electronics</td>
<td>fuzzy analytic hierarchy process</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

P.S 1-type; 2-reasons; 3-channels; 4-disposition method; 5-processing time; 6- Value-added effect.

Extant literatures focusing on added value of reverse logistic practices are not very common. The value –added effect of reverse logistics mentioned in literatures includes environmental benefits (Tsing.M.L, 2011), resource (Zou & Jing, 2003), enterprise operating cost (Eltayeb et al., 2010), profit (Dowlatshahi, 2010), customer value (Mollenkopf et al., 2010), customers’ loyalty (Ramanathan et al., 2011), corporate image (Hernández, 2010), corporate social responsibility (Wang, 2008) and information sharing (Olorunniwo, 2010).

Research on reverse logistics management has predominantly relied on normative quantitative research methods (see Fleischmann et al., 1997 for a review), case studies (see de Brito and Dekker,
2005, for a review) or theoretical frameworks (see e.g. Thierry et al., 1995). Table 1 summarizes those literatures about the representative survey-based empirical studies on reverse logistics.

1) The current researches on reverse logistics practices focus on the effects on the enterprise performance and selection mode of reverse logistics. Only return channels and disposition channel of backflow products have been involved, while it still remains blank in the studies on the reasons, types and the disposition time of returned products. And empirical researches haven’t been conducted in China’s context.

2) Empirical research on added value effect of reverse logistics still lies blank so that the added value framed by theory hasn’t been validated by data.

3. Methodology

The survey was conducted in three phases. First, series of site visits was conducted using semi-structured interviews. The results were then used to develop a deep interview instrument in phase II to do a pre-testing. At last, a formal questionnaire was completed to capture the broad view desired.

3.1. Phase I: Site visits

The purpose of the site visits was to gain information to facilitate development of a survey instrument that addressed relevant reverse logistics issues for practitioners in electronics industry. This was considered necessary because there is little theoretical basis for some aspects in the study, and it was not evident what type of returns and handling options should be included in questions on the instrument. The site visits included a plant tour to allow for direct observation of the process followed by an interview. The interview questions included a list of possible types and reasons of returns, reverse logistics channels, final disposition options, value-added items from reverse logistics and options for evaluation by the respondent. Three sites were visited: TCL, Skyworth and Desay, the list was refined following each visit.

3.2. Phase II: Pilot study

Pre-testing or pilot study of an instrument is considered an integral part of survey development. Following question development, the survey was reviewed by academicians with survey development expertise and refined based on their suggestions. Next, as an initial pre-test, the phase I participants were asked to respond to the survey and critique it with respect to relevance, clarity, and comprehensiveness and to provide any suggestions for improvement. An additional pilot study of respondents not included in phase I was conducted to ensure that bias was not involved due to the case study respondents’ prior familiarity with the study. These respondents were also asked to complete and then critique the survey. For the pilot study, a sample of 20 electronics industry manufacturers was drawn randomly from the GDEIA (Guangdong Electronic Industrial Association) membership list. The response rate for the pre-test was 80%. Based on findings from the pre-test, the survey was revised. The major concern from the pre-test and pilot study was the length of the questionnaire. The two-page instrument had a total of 15 questions, many of them containing multiple choices less than 7, and took an average of 15 minutes to complete by the pilot test respondents.

3.3. Phase III: Final survey

Using the information obtained from phase I and II, a final survey instrument was developed to explore reverse logistics practices of electronics industry companies in Guangdong. The first section of the questionnaire presented the basic information of respondents. In addition, the instrument contained the following major sections: reverse logistics practice, including types of returns, reasons for returns, reverse logistics channels, final disposition options, and added value effect from reverse logistics. Likert-scale questions were developed to measure the added value.

As GDEIA membership includes most of electronic enterprises in Guangdong and these enterprises are typical, each one of the sample including 345 manufacturing plants drawn from the GDEIA membership list of all members who stated their specific address and email address in their
membership profile was sent a questionnaire during the final survey. This sample frame is a convenience sample, which is appropriate given the goal of the study to collect information from as wide a range of companies as possible rather than to generalize to the population. 45 of them completed the survey through face-to-face interview, 300 of them completed the survey through emails.

4. Results

Besides 26 incomplete questionnaires, the survey yielded a sample size of 150 companies, with the response rate 69%. Only one enterprise hasn’t practiced any RL activity, while the remaining 149 enterprises have already practiced RL activities; and except one company acts as manufacturer, retailer and 3PSP simultaneously; the other 149 companies only play one role in supply chain. The basic information about surveyed enterprises is shown in Table 2. The plant sizes are measured by the employees of the company, and the unit of annual sales is CNY million.

<table>
<thead>
<tr>
<th>Supply chain role</th>
<th>Manufacturer</th>
<th>Wholesalers</th>
<th>Retailer</th>
<th>3PSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>84</td>
<td>5.4</td>
<td>2.7</td>
<td>7.4</td>
</tr>
<tr>
<td>Plant sizes</td>
<td>Less than 100</td>
<td>101–30</td>
<td>501–1000</td>
<td>Over 1000</td>
</tr>
<tr>
<td>%</td>
<td>11.33</td>
<td>30</td>
<td>11.34</td>
<td>47.33</td>
</tr>
<tr>
<td>Annual sales</td>
<td>Blow 10</td>
<td>10 -50</td>
<td>50 -100</td>
<td>Over 100</td>
</tr>
<tr>
<td>%</td>
<td>7.33</td>
<td>20</td>
<td>30</td>
<td>42.67</td>
</tr>
</tbody>
</table>

4.1. Reliability and validity analysis

Table 3 tested the reliability and validity of the added value scale of RL. P<0.001, KMO >0.6 showed that the data were rather validity for factor analysis. Cronbach's Alpha coefficient reached 0.744>0.7, denoting a high reliability of the scale.

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>0.744</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</td>
<td>.706</td>
</tr>
<tr>
<td>Bartlett Test of Sphericity</td>
<td>Approx. Chi-Square</td>
</tr>
<tr>
<td></td>
<td>df</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
</tr>
</tbody>
</table>

4.2. Types of return

As shown in Fig.1, Warranty returns are the most commonly-practiced type by 82% of respondents, followed by marketing/sales returns by 71.33% of respondents. These two types of RL activities have taken the highest proportions among all of the RL activities, with the average proportion reaching 35.6% and 31.4% respectively, which can be explained by the fact that these are relatively close to the selling process and are generally returned to the original supply chain actors, i.e., retailers, producers, and wholesalers.
In term of the stimulating factors of RL activities, 34% of respondents consider cost as the most concerned item, followed by social responsibility. Requirement of law is the least heeded factor. Regarding barrier factors, 4 factors have yielded equal influence on hampering the development of RL. Relatively, the strongest influence was the high operation cost, which coincides with the fact that development cost is the primary concern of carrying out RL activities. The least factor is non-standard operation of RL. (Fig 2)

4.3. Reason, channels and disposition method of returns

As regard to the reason for returns (shown in Table 4), defective quality is listed as the primary reason, existing in 78.52% of respondents’ return activities. Damage in shipment comes next, with a proportion of 50%. Returns from stock adjustment took the smallest proportion of 12.75%.

With regard to channels of returns, 24 enterprises adopted two channels, 4 enterprises adopted 3 channels. The rest 121 enterprises adopted one return channel (shown in Table 4). No matter seen from the entire 149 enterprises or from the 121 enterprises chose single channel, equal amount of enterprises have chosen each channel, despite of the low cost and low demands on enterprises for technology of third party channel.

As to the disposition of returns (Table 4), the most common options are repairing/refurbishing/remanufacturing and cleaning the defect-free products or reusing directly, with the
proportion of 49.7% and 46.98% respectively. As in the time-consuming of waste disposition (Fig.3.), 77.85% of enterprises would treat the returned products within a time span of 4-30 days. Only 3.36% enterprises would treat the returned products over 60 days, and none of the enterprises spent less than 3 days.

Table 4. Reasons, Channels and the disposition methods of returns

<table>
<thead>
<tr>
<th>Reasons for return</th>
<th>Damage during shipment</th>
<th>Customer’s dissatisfaction</th>
<th>Errors or delays in delivery</th>
<th>Defective</th>
<th>Cancellation of sale orders</th>
<th>Stock adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>48.99</td>
<td>36.91</td>
<td>28.86</td>
<td>78.52</td>
<td>20.13</td>
<td>12.75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channels</th>
<th>Forward channel meant for sales</th>
<th>Separate reverse channel, under our company's responsibility</th>
<th>3PSP</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>121 companies</td>
<td>28</td>
<td>31</td>
<td>39</td>
<td>2</td>
</tr>
<tr>
<td>All companies</td>
<td>35.6</td>
<td>32.9</td>
<td>42.95</td>
<td>9.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disposition options</th>
<th>Clean or reuse</th>
<th>Repair, refurbish, remanufacture</th>
<th>Harvest for parts/components reuse</th>
<th>Recycle for material reuse</th>
<th>Landfill or incinerate</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>46.98</td>
<td>49.7</td>
<td>30.9</td>
<td>31.5</td>
<td>19.5</td>
<td>9.4</td>
</tr>
</tbody>
</table>

Fig 3. Time consuming status of waste disposition

4.4. Awareness status of RL and the added value effect

Fig 4. Awareness of the necessity of RL and added value effect
Only one of the surveyed enterprises hasn’t taken up RL activities. However, as can be seen from Fig.4, only 86% of enterprises believe it is quite necessary to develop RL, and 59% of enterprises are convinced that RL activities would bring added value to enterprises. However, among the other 41% only one enterprise convince RL activities would not bring added value and doesn’t carry out RL activities.

Respondents were provided with a list of eight potential added value items brought about by RL and asked to rate them on a scale of 1–5 on what extent the RL services lead to the increased value. As can be seen from Table 5, ‘satisfaction of customers’ got the highest average score of 4.11, and ‘Improve profitability of customers’ got only an average score of 2.96. The other 6 indexes scored within the range of 3–4, indicating enterprises tended to think RL could bring added value to enterprises from all 7 aspects except improving profitability of customers.

<table>
<thead>
<tr>
<th>Potential Added Value Items</th>
<th>Mean</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Enterprise’s growth</td>
<td>Economic benefit</td>
<td>Enterprise’s popularity</td>
</tr>
<tr>
<td>Contributions</td>
<td>4.11</td>
<td>.771</td>
<td>.094</td>
<td>.109</td>
</tr>
<tr>
<td>Environmental performance of firm</td>
<td>3.73</td>
<td>.708</td>
<td>-.232</td>
<td>.354</td>
</tr>
<tr>
<td>Social responsibility performance</td>
<td>3.69</td>
<td>.676</td>
<td>.359</td>
<td>.030</td>
</tr>
<tr>
<td>Improve Corporate Image</td>
<td>3.69</td>
<td>.357</td>
<td>-.022</td>
<td>.696</td>
</tr>
<tr>
<td>Savings on purchasing by reuse</td>
<td>3.51</td>
<td>.206</td>
<td>.848</td>
<td>-.024</td>
</tr>
<tr>
<td>Increase loyalty of customers</td>
<td>3.50</td>
<td>.761</td>
<td>.359</td>
<td>-.083</td>
</tr>
<tr>
<td>Provide more information about products</td>
<td>3.17</td>
<td>-.095</td>
<td>.217</td>
<td>.789</td>
</tr>
<tr>
<td>Improve profitability</td>
<td>2.96</td>
<td>.086</td>
<td>.733</td>
<td>.417</td>
</tr>
</tbody>
</table>

Notes: 1—not at all, 2—a little, 3—some, 4—moderate, 5—very much.

After factor analyzing, 3 added-value factors of RL are finally obtained (Table 5). The first factor (enterprise’ growth) had rather great loadings on satisfaction of customers, loyalty of customers, environmental performance of enterprises and social responsibility performance, indicating RL had added value effect on expansion of customer base and social environment. The second factor (economic benefit) is most correlated with measures of improving enterprise profitability and saving purchasing cost, indicating RL’s added value on economic benefit. The third factor (enterprise’s popularity) is most correlated with those of providing more information about product and improve enterprise’s image, indicating RL had added value effect on enterprises reputations. Because variance contribution extracted by factor 1 reached 36.68%, RL’s added value effect on enterprise’s growth is the greatest.

5. Discussion and implications
5.1. Discussion

Several insights can be summarized from the results as follows.

Firstly, regarding the goals of practicing RL, enterprises’ positive acknowledgement of RL is far from sufficient. Fig 4 indicates 40.3 % of enterprises carry out RL not in pursuit of added value to enterprises themselves. They might be obliged by national policy, tough requirements by laws and regulations, or, blindly follow partners with the industry or rivals. And among those that believed RL was necessary, 20.16% of enterprises are not certain whether RL would bring added value to enterprises, and one even believed RL would not bring added value to enterprises.

Secondly, the majority 2 types of return practice are warranty returns and sales/marketing related returns, which are the two most popular ways of returns by the real-life consumers. As to reasons for returns, 78.5% of the enterprises experience returns for quality deficiency reason, indicating that most
enterprises practice RL not to recycle the available resource positively, but are forced to do it for
quality reasons to save the image and the customers’ confidence. Besides, 48.99% of enterprises
practice recycling for transportation damages, indicating logistics transportation process in China is
still non-standardized and with lower technology.
Thirdly, regarding the disposition options, the shares of every channel of recycling products are
close, with the third-party channel slightly outnumbering other options. The most popular disposition
options are to clean or reuse directly the flawless products and to repair/refurbish/remanufacture
products.
Lastly, as for the value-added effect of RL, enterprises hold negative attitude to the role of added
value in increasing profits, while prefer positive attitude to the role in the other 7 aspects, especially
customers satisfaction. Among the three chief added value factors, enterprise growth is the most
effected factor and enterprise awareness is the least effected factor by RL activity.

5.2. Implications
The above insights of RL practices help the enterprise to develop RL strategy and government to
make industry policy.
First, it is important for Chinese government to enhance the publicity of RL and step up the related
legislation. On one hand, the government should not only highlight the importance but also to enhance
publicity so that to make the decision-makers of enterprises better realize the value brought in by RL.
On the other hand, it is very urgent for the government to make EPR system to be implanted effectively
to impel enterprises to take the full responsibility of the whole life-cycle of their products.
Second, enterprises should establish reasonable and efficient RL channel. Most enterprises insisted
in focusing on forward logistics, even though they have realized the economic value of RL (Guide et
al., 2005). Actually, it is not that many wasted materials cannot be recycled, just that there are no
low-cost, convenient and efficient way of recycling. Therefore, enterprises should invest more on
developing new recycling system and take the integration of forward and RL into full account
(Fleischmann et al., 2000). At the same time, minor enterprises with limited funds should use 3PSP
with advantages in technology, management and information to implement RL management.

6. Conclusions and further work
Through a survey in 150 electronics enterprises of Guangdong province, this paper analyzes the RL
practices in Guangdong province, China. Some suggestions on how to promote the development of the
RL are proposed.
The current study has several limitations that offer opportunities for future research. Care should be
taken when generalizing the results of this study for two reasons. First, this survey was conducted using
a face-to-face questionnaire in electronic industry in Guangdong, findings may differ in other industries,
cities and countries. Besides, this survey took a relatively small sampling of only 150 enterprises.
Generalizability could be enhanced if future research is systematically sampled from a more dispersed
sample by using some random sampling methods.

7. Acknowledgement
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8. References
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